

CONSERVATION AGREEMENT AND STRATEGY

FOR

BONNEVILLE CUTTHROAT TROUT (*Oncorhynchus clarki utah*)

in the
State of Utah



Photo by Dale Hepworth, UDWR

Publication Number 97-19

March 1997

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in the State of Utah

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Publication Number 97-19

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Division of Wildlife Resources
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An Equal Opportunity Employer

John Kimball
Director

March 1997

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CONSERVATION AGREEMENT

FOR

BONNEVILLE CUTTHROAT TROUT

in the

State of Utah

CONSERVATION AGREEMENT

This Conservation Agreement (Agreement) has been developed to expedite implementation of conservation measures for Bonneville cutthroat trout (BCT) in Utah as a collaborative and cooperative effort among resource agencies. Threats that warrant BCT listing as a sensitive species by state and federal agencies and as threatened or endangered under the Endangered Species Act of 1973, as amended, should be eliminated through implementation of this Agreement and the attached Conservation Strategy (Strategy)(Attachment B).

GOAL:

Ensure the long-term conservation of BCT within its historic range in Utah.

OBJECTIVES:

The following two objectives will be required to attain the goal of this strategy:

- 1) Restore and maintain at least 62 conservation populations of BCT throughout 332.1 stream miles and 35,775 surface acres including a sufficient number of metapopulations where possible within five Geographic Management Units (GMU).
- 2) Eliminate or minimize threats to BCT and its habitat to the greatest extent possible.

These objectives will be reached through implementation of the Strategy. Upon signing, the signatories agree to remove BCT from all lists that require federal and state regulatory administration. The sensitive species list of the USDA Forest Service is a tracking and monitoring list, not a regulatory administration list. As such, the species would remain on the USDA Forest Service "sensitive species" list to be reviewed every 5 years after signing of the agreement. However, the status of BCT will be evaluated annually to assess program progress and amendments will be added to address newly identified BCT recovery issues and to ensure program effectiveness. Failure to implement the BCT Agreement and Strategy, however, will result in replacement of BCT onto appropriate lists.

The BCT is a unique subspecies of the cutthroat trout complex native to the Bonneville Basin. During the Pleistocene, Lake Bonneville and its drainage covered parts of Utah, Nevada, Idaho, and Wyoming. Historically, BCT occurred throughout this drainage. With desiccation of ancient Lake Bonneville, BCT became restricted to headwater streams and lakes with suitable trout habitat. Human activities such as water development, agricultural activities, energy development, mining, timber harvesting, grazing, over fishing and the introduction of non-indigenous species have directly impacted BCT populations and altered the Bonneville Basin ecosystem. Because of the tenuous status of remaining BCT populations and habitat, BCT conservation efforts have been directed through federal, state and local agencies.

I. OTHER SPECIES INVOLVED

The primary focus of this agreement is the conservation and enhancement of BCT and the ecosystems upon which they depend; however, other species occurring within or adjacent to BCT

habitat may also benefit. Some of these species include Bonneville cisco (*Prosopium gemmiferum*), Bonneville whitefish (*Prosopium spilinosus*), Bear Lake whitefish (*Prosopium abysicola*), Bear Lake sculpin (*Cottus extensus*), Piute sculpin (*Cottus beldingi*), leatherside chub (*Gila copei*) and boreal toad (*Bufo boreas*). Using an ecosystem approach, the Bonneville Cutthroat Trout Conservation Agreement could reduce or possibly eliminate threats for several of these species, which could preclude their need for Federal listing pursuant to the ESA.

II. INVOLVED PARTIES

Utah Department of Natural Resources
Division of Wildlife Resources
1596 West North Temple
Salt Lake City, UT 84116

Confederated Tribes of the Goshute Reservation
PO Box 6104
Ibapah, UT 84034

United States Department of Interior
Fish and Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, CO 80225

Bureau of Land Management
Utah State Office
324 South State Street
Salt Lake City, UT 84111

Bureau of Reclamation
125 South State, Room 6107
Salt Lake City, UT 84138

United States Department of Agriculture
Forest Service
Intermountain Region
324 25th Street
Ogden, UT 84401

Utah Reclamation Mitigation and Conservation Commission
102 West 500 South #315
Salt Lake City, Utah 84101

Separate Memorandum(a) of Understanding and Cooperative Agreements will be developed with additional parties and supporting entities (Appendix A) as necessary to ensure implementation of specific conservation measures. In addition, interested County governments will be given an opportunity to review and provide input on specific actions.

While the Utah Field Office, Region 6, of the Fish and Wildlife Service (USFWS) maintains the Federal lead in the recovery efforts for the BCT, BCT distribution is not limited to Utah. Additional populations of BCT exist in Idaho, Nevada, and Wyoming. Conservation Plans and/or Agreements exist in each of these States for the management of BCT. The Bonneville Basin Conservation and Recovery Team will cooperate and coordinate with these States in the implementation of this Agreement. Additionally, the Service's Utah Field Office and the State of Utah Division of Wildlife Resources will take the lead in developing an umbrella document to coordinate management of BCT throughout its range.

III. AUTHORITY

* The signatory parties hereto enter into this Conservation Agreement and the attached Conservation Strategy under Federal and State law, as applicable, including, but not limited to Section 2(c)(2) of the Endangered Species Act of 1973, as amended, which states that "the policy of Congress is that Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species."

* All parties to this Agreement recognize that they each have specific statutory responsibilities that cannot be delegated, particularly with respect to the management and conservation of these fish, their habitat and the management, development and allocation of water resources. Nothing in this Agreement or the Strategy is intended to abrogate any of the parties' respective responsibilities.

* This Agreement is subject to and is intended to be consistent with all applicable Federal and State laws and interstate compacts.

* This instrument in no way restricts the parties involved from participating in similar activities with other public or private agencies, organizations or individuals.

* Modifications within the scope of this instrument shall be made by the issuance of a bilaterally-executed modification prior to any changes being performed.

IV. STATUS AND DISTRIBUTION OF THE BONNEVILLE CUTTHROAT TROUT

In 1979, the American Fisheries Society (AFS) designated BCT as "threatened" throughout its range because of habitat degradation, hybridization and competition with nonnative species. Until February 28, 1996, BCT was considered candidate species for federal listing (Notice of Review 1980; 45 FR 19857). In 1989, the AFS reclassified BCT as "endangered" after more information was obtained. The BCT is currently considered a species of special concern (S1 status) within the state of Utah.

The Regional Forester for the Intermountain Region of the U.S. Forest Service (USFS) (R4) has designated the BCT as “sensitive”. This administrative designation is defined in the Forest Service Manual 2670.5 as follows: “Sensitive Species. Those plant and animal species identified by a Regional Forester for which population viability is a concern as evidenced by: a. Significant current or predicted downward trends in population numbers or density. b. Significant current or predicted downward trends in habitat capability that would reduce a species’ existing distribution.” Twelve criteria are used in this Region in designating species as sensitive. These are: (1) relative abundance of the species within the range, (2) recruitment potential as to life history style, (3) population trend over the past 10 years, (4) distribution across the region, (5) plant communities inhabited, (6) unique habitat or special features upon which the species depends, (7) ability of a species to disperse or relocate, (8) the species specialization for reproduction and feeding, (9) hybridization potential, (10) ability for habitat to recover, (11) potential for habitat to be impacted by human activity, and (12) habitat trend. The status of BCT was evaluated in the late 1980's against these criteria and was determined to warrant regional designation as sensitive. The designation of the BCT as sensitive by the USFS will be evaluated each 5 years after the signing of this agreement.

Manual Direction directs line officers to manage for and maintain viable populations of native and desirable nonnative species (FSM 2602, 1b). When a species is designated as sensitive, decision makers must review and analyze the impacts of proposed management activities on the species and their habitat. This analysis is done in a “biological evaluation” (BE). The BE is part of the project file upon which a decision maker bases their decision and allows the decision maker to understand the potential impacts on individual species of concern. While the BE does not establish standards or guidelines, it may include recommended mitigation measures. The decision maker is not forced into or required to make any particular decision based on the BE. This designation as sensitive is designed to increase awareness of population viability concerns, and therefore encourage decisions which will not contribute to those concerns and which may prevent a species from becoming a federally threatened or endangered species.

To encourage proactive management of this species and alleviate local concerns about effects of reintroductions on current activities, the U.S. Forest Service has agreed to not treat as ‘sensitive’ any BCT population established through transplanting onto National Forest System land, proceeding from the date of signing of the Agreement. However, the U.S. Forest Service will continue to treat as ‘sensitive’ any remnant BCT population found on National Forest System land.

In addition to protective legislation, the U.S. Fish and Wildlife Service, the U.S. Forest Service, Bureau of Land Management (BLM), and the State of Utah have initiated stream improvement projects, population and habitat surveys, brood stock development and reintroductions over the past decade. These efforts allowed managers to expand known BCT range since the 1970's. As a result, the status of BCT still appears tenuous but has increased in some areas during the last 20 years.

Presently, a total of 40 known BCT populations occupy approximately 147.4 stream miles and 35,108 surface acres of lentic water throughout regions of Utah. These populations, as well as

numerous additional BCT populations, are continuing to be analyzed for purity. Because of ongoing BCT conservation and sportfishing management, the future of this subspecies is more promising than it was in the 1970s.

V. PROBLEMS FACING THE SPECIES

The success of any conservation or recovery program depends on eliminating or reducing the impact of activities that threaten the species existence. The following list is a compilation of threats as perceived by the Bonneville Basin Conservation and Recovery Team (BBCRT). For consistency, the general format is based on the five criteria considered for federal listing of a species in Section 4(a)(1) of the Endangered Species Act of 1973, as amended. The Conservation Strategy provides a detailed review of problems and threats to the species that signatories to this agreement will address with management actions.

- A. The present or threatened destruction, modification, or curtailment of its habitat or range.
- B. Over utilization for commercial, recreational, scientific, or educational purposes.
- C. Disease, predation, competition and hybridization.
- D. The inadequacy of existing regulatory mechanisms.
- E. Other natural (e.g. drought) or human induced (e.g. socio-political) factors affecting its continued existence.

VI. CONSERVATION ACTIONS

To meet the goal and objectives of this Agreement, the following conservation actions, as defined and detailed in the Strategy, must be implemented:

- 1) Determine baseline BCT population, life history and habitat data.
- 2) Determine and maintain genetic integrity.
- 3) Enhance, maintain and protect habitat.
- 4) Selectively control nonnative species.
- 5) Expand BCT populations and range through introduction or reintroduction from either transplanted (wildstock) or broodstock BCT raised in a designated hatchery.
- 6) Monitor populations and habitat.
- 7) Develop a mitigation protocol for proposed water development and future habitat alteration, where needed.

Coordinating Conservation Activities

* Administration of the conservation agreement will be conducted by the BBCRT in coordination with other involved states. The team will consist of a designated representative from each signatory to this Agreement and may include technical and legal advisors and other members as deemed necessary by the signatories.

- * Because the areas of concern covered by this Agreement are located in Utah, and because the State of Utah presently has primary jurisdiction over BCT within the State, the designated team leader will be the Utah Department of Natural Resources, Division of Wildlife Resources representative.
- * Authority of BBCRT shall be limited to making recommendations for the conservation of BCT to the Director of the Utah Division of Wildlife Resources. The Director will provide copies of comments to the signatories and to other interested parties upon request.
- * The BBCRT will meet annually to develop yearly conservation schedules, review budgets, and review and revise the Strategy as required.
- * Modifications within the scope of this instrument shall be made by the issuance of a bilaterally executed modification prior to any changes being preformed.
- * The BBCRT will meet on a semiannual basis to report on progress and effectiveness of the Conservation Strategy implementation.
- * BBCRT meetings will be open to the public. Minutes of the meetings and progress reports will be distributed to the BBCRT, the technical advisory team and to other interested parties upon request.

Implementing Conservation Schedule

- * A total of 10 years is anticipated for completion of all actions identified and specified in the Conservation Strategy. Nevertheless, the parties agree that significant actions to benefit BCT will be implemented within the first five (5) years as funds become available. Actions will be determined by the BBCRT.
- * Conservation actions will be scheduled and reviewed on an annual basis by the signatories on recommendations from the team. Activities that will be conducted during the first year of implementation are listed in Table 1. The Strategy is a flexible document and will be revised annually.
- * As leader of the BBCRT, the Utah Division of Wildlife Resources, Department of Natural Resources will coordinate conservation activities and monitor conservation actions conducted by participants of this Agreement to determine if all actions are in accordance with the Conservation Strategy and annual schedule.

Funding Conservation Actions

- * Expenditures to implement this Agreement could exceed \$2,000,000 (Table 2). It is projected that expansion of habitat and population actions will require the greatest expense during the first five years of the agreement.

* Funding for the Conservation Agreement will be provided by a variety of sources. Federal, State and local sources will need to provide or secure funding to initiate procedures of the Conservation Agreement and Strategy.

- Federal sources may include, but are not limited to, the USFS, USFWS, BLM, Land and Water Conservation funds and the Natural Resource Conservation Service.

- State funding sources may include, but are not limited to, direct appropriation of funds by the legislature, Community Impact Boards, Water Resources Revolving funds, State Department of Agriculture (ARD), and State Resource Management Agencies.

- Local sources of funding may be provided by water districts, Native American affiliations, cities and towns, counties, local irrigation companies, and other supporting appropriations and may be limited due to factors beyond local control.

* In-kind contributions in the form of personnel, field equipment, supplies etc., will be provided by participating agencies (Table 3). In addition, each agency will have specific tasks, responsibilities and proposed actions/commitments related to their in-kind contributions.

* It is understood that all funds expended in accordance with this Agreement are subject to approval by the appropriate local, state or Federal appropriations. This instrument is neither a fiscal nor a funds obligation document. Any endeavor involving reimbursement or contribution of funds between the parties to this instrument will be handled in accordance with applicable laws, regulations, and procedures, including those for Government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the parties and shall be independently authorized by appropriate statutory authority. This instrument does not provide such authority. Specifically, this instrument does not establish authority for noncompetitive awards to the cooperator of any contract or other agreement. Any contract or agreement for training or other services must fully comply with all applicable requirements for competition.

Conservation Progress Assessment

* A semiannual assessment of progress towards implementing actions identified in this agreement will be provided to the Director, Utah Division of Wildlife Resources by BBCRT. This assessment will be based on updates and evaluations by BBCRT members. The Director will provide copies of this assessment to the signatories of this document.

* An annual assessment of conservation accomplishments identified in Table 1 and subsequent yearly schedules will be made by the BBCRT. This assessment will determine the effectiveness of this agreement and whether revisions are warranted. It will be provided to the Director of the Utah Division of Wildlife Resources by BBCRT. The Director will provide copies of this assessment to the signatories of this document.

* If threats to the survival of the BCT become known that are not or cannot be resolved through this or any Conservation Agreement, the Utah Division of Wildlife Resources immediately will notify all signatories.

VII. DURATION OF AGREEMENT

The initial term of this Agreement shall be 5 years. Prior to the end of each 5 year period, a thorough analysis of actions implemented for the species will be conducted by the BBCRT. If all signatories agree that sufficient progress has been made towards the conservation and recovery of the BCT this Agreement shall be extended for an additional five (5) years. Any party may withdraw from this Agreement on sixty (60) days written notice to the other parties.

VIII. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE

Signing of this agreement is covered under authorities outlined in section III listed above. We anticipate that any survey, collection or non-land disturbing research activities conducted through the Conservation Agreement will not entail significant Federal actions under the NEPA and will be given a categorical exclusion designation. However, each signatory agency holds the responsibility to review planned actions for their area of concern to ensure conformance with existing land use plans and to conduct any necessary NEPA procedures for those actions within their area.

IX. FEDERAL AGENCY COMPLIANCE

* During the performance of this agreement, the participants agree to abide by the terms of Executive Order 11246 on non-discrimination and will not discriminate against any person because of race, color, national origin, age, religion, gender, disability, familial status or political affiliation.

* No member or delegate to Congress or resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

X. SIGNATORIES

Utah Department of Natural Resources
Utah Division of Wildlife Resources
1596 West North Temple
Salt Lake City, UT 84116

Robert G. Valentine
Director

11/14/96
Date

Signed copies of this document are available upon request from the Salt Lake Office of the Utah Division of Wildlife Resources.

USDI Fish and Wildlife Service
P.O. Box 25486
Denver, CO 80225

Ralph O. Morgenweck
Regional Director

11/14/96
Date

USDI Bureau of Land Management
324 South State Street
Salt Lake City, UT 84111

William Lamb
State Director

4/11/97
Date

USDA Forest Service
Intermountain Region
324 25th Street
Ogden, UT 84401

Jack Blackwell
Regional Forester (Acting)
FS Agreement Number 37-MOU-98-007

12/9/97
Date

Confederated Tribes of the Goshute Reservation
PO Box 6104
Ibapah, UT 84034

_____4/7/97_____
name Date
Title

USDI Bureau of Reclamation
125 South State, Room 6107
Salt Lake City, UT 84138

_____5/9/97_____
Charles Calhoun Date
Regional Director

Utah Reclamation Mitigation and Conservation Commission
102 West 500 South #315
Salt Lake City, UT 84101

_____3/27/97_____
Michael C. Weland Date
Executive Director

Table 1: Conservation Actions to be Implemented in Calendar Year 1996-1997

A) Salt Lake Office

Salt Lake Office	1997	UDWR	<ul style="list-style-type: none"> - Refine definition of metapopulation - Determine number of metapopulations to be established among regions
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B) Bear Lake Unit

SUB-BASIN/DRAINAGE/AREA	DATE	LEAD	ACTIONS
Bear Lake			- Maintain existing conditions
Tributaries	12/96	UDWR UDWR	<ul style="list-style-type: none"> - Reestablish population in Lake Town Creek - Initiate reestablishment of spawning habitat in Big Spring Creek

C) Bear River Unit

SUBBASIN/DRAINAGE/AREA	DATE	LEAD	ACTIONS
Uinta Mountain	8/96	UDWR UDWR UDWR	<ul style="list-style-type: none"> - Obtain disease certification for Mill Creek - Complete genetic analysis of samples on-hand - Complete meristics for samples on-hand
Rich County	11/96 6/97 6/97	UDWR UDWR UDWR UDWR	<ul style="list-style-type: none"> - Identify streams that need surveyed - Initiate survey of streams identified above - Establish population at DL & L Ranch - Survey Woodruff Creek drainage and reservoir
Cache Valley	ongoing ongoing	UDWR UDWR UDWR USFS	<ul style="list-style-type: none"> - Survey streams for whirling disease - Determine feasibility of whirling disease containment activities - Continue public education on whirling disease - Population/Habitat inventory on Blacksmith Fork

D) Northern Bonneville Unit

SUB-BASIN/DRAINAGE/AREA	DATE	LEAD	ACTIONS
Ogden River	ongoing ongoing	UDWR UDWR UDWR USFS	- Survey streams for whirling disease - Determine feasibility of whirling disease containment activities - Continue public education on whirling disease - Species composition surveys on tributaries
Weber River	8/97 7/96 9/96	UDWR UDWR UDWR	- Re-establish populations in Bull Nelson and Kilfoil Creeks of Lost Creek drainage - Conduct stream surveys, collect samples and perform habitat analysis on tributaries of lower Weber - Conduct stream surveys, collect samples and perform habitat analysis on tributaries in Upper Uinta Mtn.
Jordan River	7/96 9/96 9/96 9/96 9/96 7/97 7/96 9/96 9/96	UDWR UDWR UDWR UDWR UDWR UDWR UDWR UDWR UDWR	- Collect samples from City Cr. for genetics - Monitor City Creek population - Collect eggs from Mountain Dell Creek population - Determine population size of Mountain Dell Creek - Collect samples from Mountain Dell for genetics - Collect samples from Mill Cr. for genetics - Monitor population in Little North Willow Creek - Monitor Red Butte Reservoir population - Collect eggs from Red Butte Reservoir population
Utah Lake	12/96	UDWR	- Establish restrictive fishing regulations in Hall's Fork, Chases, Shingle Mill, and Yellow Jacket Cr.
Provo River	8/96	UDWR UDWR UDWR	- Collect samples from South Fork and Little Deer Cr. - Acquire funding to initiate habitat enhancement of mid and lower Provo River - Evaluate tributaries in Upper Provo River

E) West Desert Unit

SUB-BASIN/DRAINAGE/AREA	DATE	LEAD	ACTIONS
East Slope of the Deep Creek Mtns	5/96-8/96	UDWR	- Study spawning habits in Trout Cr.
	5/96-8/96	UDWR	- Complete population estimates in Trout, Birch Cr.
	5/96-8/96	UDWR	- Move 100 trout downstream in Birch Cr.
	5/96-8/96	UDWR	- Evaluate 1995 eradication project of Tom's Cr.
	5/96-8/96	UDWR	- Move 100 trout from Trout to Tom's Cr.
	5/96-8/96	UDWR	- Collect and release invertebrates in Tom's Cr.
West Slope of the Deep Creek Mountains (Goshute Reservation)	5/96-8/96	UDWR	- Move 100 BCT into headwater fishless stream reach
	1996	USFWS	- Periodically measure discharge in streams
	1996	USFWS	- Conduct population estimates for rainbows and hybrids in Spring and Fifteen Mile Creeks
	1996	USFWS	- Analyze macroinvertebrates from Spring Creek
	1996	USFWS	- Enhance fish barrier on Spring Creek
	1996	USFWS	- Eradicate rainbows and hybrids from upper section of Spring Creek (above fish barrier)
	1996	USFWS	- Develop a plan for construction of small reservoir(s) on Reservation
	1997	USFWS	- Transplant BCT to Spring Creek from other occupied stream on or near Reservation
	1997	USFWS	- Do intensive fish survey of Johnson Creek to identify source of pure strain BCT sampled in 1995
	1997	USFWS	- Evaluate 1996 eradication of Upper Spring Creek
	1997	USFWS	- Construct small reservoirs on the Reservation to augment BCT conservation

F) Southern Bonneville Unit

SUB-BASIN/DRAINAGE/AREA	DATE	LEAD	ACTIONS
Virgin River	1996 1996	UDWR USFS	- Discontinue stocking of nonnative cutthroat trout; stock BCT in replacement - Conduct R-1 and R-4 habitat surveys on Leeds, South Ash, and Leap creeks and tributaries.
Beaver River	1996 1996 1996 1996	UDWR UDWR USFS BLM BLM	- Discontinue stocking of nonnative cutthroat trout; stock BCT in replacement - Conduct R-1/ R-4 habitat surveys - Maintain and/or modify barrier on North Fork of North Creek. - Improve road stream crossing on Birch Creek to prevent habitat damage. - Annual fence maintenance and livestock exclosure checks on Birch Creek.
Sevier River	1996 1996 9/96 10/96 4/96 1996 7/96 6/96 1996 1996 1996 1996 1996 1996 1996	UDWR UDWR UDWR UDWR UDWR UDWR UDWR UDWR UDWR UDWR USFS BLM BLM USFS USFS	- Discontinue stocking of nonnative cutthroat trout; stock BCT in replacement - Evaluate and/or modify barrier constructed on Manning Creek in 1995. - Chemically treat Manning Creek. - Reintroduce BCT into Manning Creek. - Obtain approval and permits to construct fish barrier on Sam Stowe Creek. - Complete NEPA requirements for treatment of Sam Stowe Creek. - Complete disease certification inspection of Manning Meadow Reservoir. - Take eggs from spawning fish at Manning Meadow Reservoir and culture fish in state hatcheries. - Complete DNA analysis of samples from Ranch Creek, Deep Creek and Sam Stowe Creek. - Investigate other possible streams for replication of populations from Deep Creek and Ranch Creek for future reintroduction of BCT. - Evaluate and/or modify barrier enhancement work conducted on Threemile Creek in 1995. - Continue annual fence maintenance and livestock exclosure checks on Threemile Creek. - Construct barrier on lower end of Threemile Creek. - Complete R-1 and R-4 habitat surveys on Deep Creek. - Establish reference sites for monitoring livestock exclosure on Threemile Creek and general habitat conditions on Deep Creek.

Table 2. Estimated Costs for Implementing the Bonneville Cutthroat Trout Conservation Agreement over 10 yr period.

Conservation Agreement Actions	Estimated Costs(\$)
<i>Population and Habitat Expansion:</i> - Bear Lake Unit - Bear River Unit - Northern Bonneville Unit - West Desert Unit - Southern Bonneville Unit	\$500,000
<i>Habitat Maintenance and Enhancement:</i> - Bear Lake Unit - Bear River Unit - Northern Bonneville Unit - West Desert Unit - Southern Bonneville Unit	\$250,000
<i>Population Genetics Management:</i> - Bear Lake Unit - Bear River Unit - Northern Bonneville Unit - West Desert Unit - Southern Bonneville Unit	\$400,000
<i>Non-Indigenous Fish Management:</i> - Bear Lake Unit - Bear River Unit - Northern Bonneville Unit - West Desert Unit - Southern Bonneville Unit	\$150,000
<i>Population and Habitat Monitoring:</i> - Bear Lake Unit - Bear River Unit - Northern Bonneville Unit - West Desert Unit - Southern Bonneville Unit	\$750,000
<i>Administration:</i>	\$100,000

Table 3: Estimated agency in-kind contributions, actions, and responsibilities for implementation of the Bonneville Cutthroat Trout Conservation Agreement and Strategy.

Agency	Brief Description of Tasks and Responsibilities *
Utah Department of Natural Resources, Utah Division of Wildlife Resources	Serve as BCT conservation team leader (e.g.: oversee administrative responsibilities of agencies, reports, meetings etc.). Consult on water protection issues. Serve as lead agency for population and habitat enhancements, re-introductions, non-indigenous control projects and monitoring projects. Assist in obtaining and/or securing water rights and land within BCT habitat. Assist in funding enhancement projects.
U.S. Fish and Wildlife Service	Advise and assist in implementation of conservation agreement in regard to existing laws (e.g.: ESA, NEPA etc.). Cooperate and assist in habitat enhancement, re-introduction, non-indigenous species control and monitoring projects. Assist in funding statewide enhancement projects. Serve as lead in projects occurring on Goshute Indian Reservation lands.
U.S. Forest Service	Cooperate and assist in state-wide habitat enhancement, re-introduction, non-indigenous species control, and monitoring projects. Assist in obtaining and/or securing water rights and land within BCT habitat. Assist in funding state-wide enhancement projects on NFS lands where appropriate.
U.S. Bureau of Land Management	Cooperate and assist in state-wide habitat enhancement, re-introduction, non-indigenous species control, and monitoring projects. Support the state in obtaining and/or securing water rights and land within BCT habitat. Assist in funding enhancement projects Assist in funding state-wide enhancement projects with compliance to NEPA regulation.
U.S. Bureau of Reclamation	Advise and assist in implementation of conservation agreement. Cooperate and assist in habitat enhancement, re-introduction, non-indigenous species control and monitoring projects. Assist in funding statewide enhancement projects.
Utah Reclamation Mitigation and Conservation Commission	Advise and assist in implementation of conservation agreement. Cooperate and assist in habitat enhancement, re-introduction, non-indigenous species control and monitoring projects. Assist in funding statewide enhancement projects.

* All agencies will participate in, and provide technical and administrative assistance to the Bonneville Basin Conservation and Recovery Team

Attachment A
Supporting Entities

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**CONSERVATION AND SPORTFISHING
MANAGEMENT STRATEGY**

FOR

BONNEVILLE CUTTHROAT TROUT

in the

State of Utah

CONSERVATION AND SPORTFISHING MANAGEMENT STRATEGY

INTRODUCTION

As stated in the Bonneville cutthroat trout (BCT) Conservation Agreement (Agreement), implementation of specific conservation actions detailed in this Conservation and Sportfishing Management Strategy (Strategy) will eliminate threats that warrant listing of BCT as a sensitive species by state and federal agencies, and as threatened or endangered under the Endangered Species Act of 1973, as amended.

The primary purpose of this document is to describe the specific technical procedures and strategies required to provide for the long-term conservation of BCT in Utah. A second purpose is to outline information on how BCT will be used in sportfishing programs in Utah. Some actions implemented pursuant of this Strategy may reduce or eliminate threats and improve habitat for related aquatic and terrestrial sensitive species as well.

Populations of BCT in Utah will be managed under one of two concepts: 1) conservation or 2) sportfishing recreation. These concepts are described as follows:

- 1) ***Conservation:*** Individual BCT populations designated under this concept will be managed to ensure the continued existence of BCT in Utah. The intent of this approach is to preserve the genetic integrity of geographic genotypes and to maintain rare alleles within specific populations. Conservation also entails preserving ecosystem processes that existed historically. Therefore, habitat management is an important component of the management of conservation populations. Enough populations should be established to minimize impacts of habitat degradation or detrimental natural events to the populations in Utah.
- 2) ***Sportfishing recreation:*** Sportfishing populations will be managed to meet public demand and routine sportfish management objectives. Management of sportfishing populations may involve suitable nonnative species to compliment native sportfishing opportunities. Sportfishing populations will be designated for waters where: 1) other nonnative salmonid species occur, 2) the potential for self-sustaining BCT populations is inadequate or 3) hybridization cannot be prevented. The presence of sportfishing populations will not jeopardize conservation populations in the vicinity.

Throughout this document, both management concepts have been outlined and discussed so that all components of BCT management in Utah can be understood in concert. BCT sportfishing management activities may enhance BCT conservation activities and likewise, BCT conservation populations may fulfill elements of BCT sport fisheries development.

In this Strategy, conservation and sportfish management is presented at state-wide and specific geographic scales. First, **Statewide Management** describes a general overview of status,

distribution, threats, goals, objectives, and actions. Then, **Management within Geographic Units** details specific status, distribution, threats, goals, objectives, and actions within five Geographical Management Units (GMU). GMU's include: Bear Lake, Bear River, Northern Bonneville, West Desert and Southern Bonneville (Figure 1). In these sections, management is prioritized with respect to specific drainages or areas.

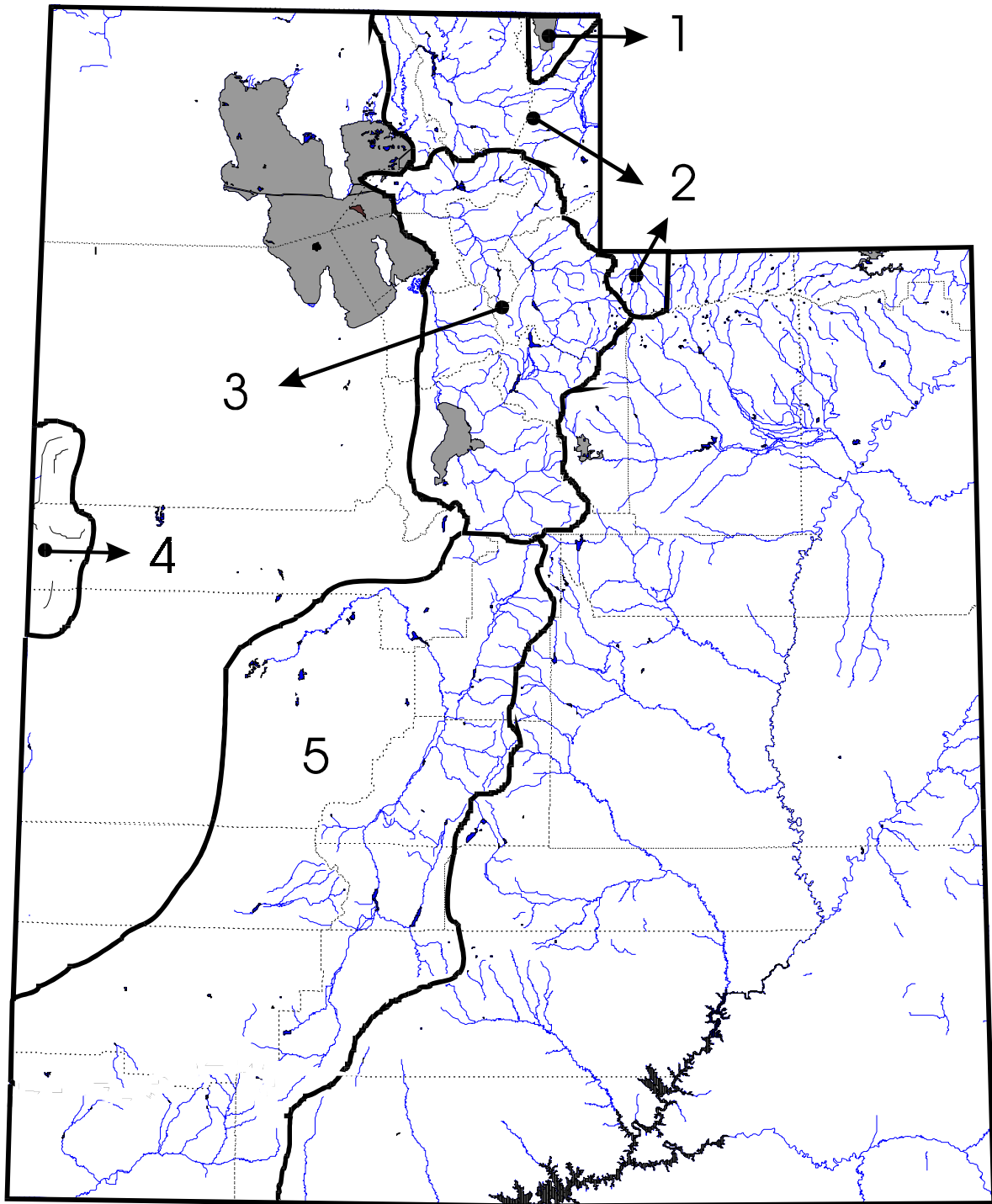


Figure 1. Geographic Management Units designated for BCT conservation within the State of Utah. 1=Bear Lake; 2=Bear River; 3=Northern Bonneville; 4=West Desert; 5=Southern Bonneville.

DEFINITIONS

For the purposes of the Agreement and Strategy, the following terms are defined:

Conservation Population - A reproducing and recruiting group of BCT, geographically isolated that is managed to sustain the existence of the BCT subspecies. Conservation populations are managed with the intention of preserving genetic integrity within specific populations and within geographic units. Populations should be further defined within geographic units by a quantifiable criterion based on the life history of the subspecies. This criterion may vary among geographic units.

Demographic Stochasticity - Random variation in demographic processes (birth, death and growth rates) that affect individual and population persistence. These changes are strictly a result of population dynamics, not environmental change. Populations are known to inherently fluctuate regardless of environmental changes. For very small populations, periods of negative growth may lead to extinction.

Environmental Stochasticity - Random variation in environmental processes (fire, flood and food availability) that affect individual and population persistence.

Genetically Pure - Considered to be without hybridization with other salmonid species and subspecies based on the best known genetic techniques and information at the time of testing. Purity ratings are subject to change as techniques for genetic analysis are improved or new techniques are developed.

Geographic Management Unit (GMU) - A distinct area within Utah defined by historic BCT range and geographic boundaries. Five GMU's have been identified within BCT range in Utah.

Historical Range - The area that BCT is perceived to have inhabited at the time of modern exploration and settlement of Utah (approximately 1850).

Hybrid - Considered to be cross bred with other salmonids, commonly rainbow trout or other cutthroat subspecies. Varying degrees of hybridization occur among populations; hence some hybridized populations may offer genetic and ecological value to the BCT conservation efforts.

Introduction - Release of BCT into historically unoccupied sites for promoting conservation or sportfishing purposes.

Metapopulation - A collection of localized populations that are geographically distinct yet are genetically interconnected through natural movement of individuals among conservation populations.

Nonnative - A fish that historically did not occur in a specific area or habitat.

Phenotype - the physical manifestation of the interaction of an organism's genetic information with its environment which results in a unique physical, physiological or behavioral trait (e.g. spotting patterns or coloration of cutthroat trout).

Potentially Pure - Considered as possibly pure based on preliminary morphological examination, location of capture site and/or anecdotal information. This purity rating is assigned to populations that either have not been analyzed in the past or that have mixed purity results and will change as purity analysis is conducted.

Reintroduction - Release of BCT into historically occupied sites for the purpose of reestablishing populations.

Remnant - Any population that has naturally persisted modern development and that naturally occurs within historically occupied streams or locales. Remnant populations do not include populations that have been introduced or reintroduced through transplanting or stocking.

Sportfishing Population - A group of BCT that is managed to provide sportfishing opportunities and with the intention of meeting a public recreational demand. These populations are maintained in addition to conservation populations and may be managed in concert with other sportfish objectives.

Transplant - Removal of BCT individuals from a naturally occurring population and subsequent release of these individuals into other waters.

BACKGROUND

CUTTHROAT TROUT

Cutthroat trout (*Oncorhynchus clarki*) are widely distributed from southern Alaska to northern California and inland in the Columbia River, Missouri River, Southern Rocky Mountains, and the Great Basin drainages. This species comprises fourteen subspecies according to Behnke (1992), three of which are native to Utah. Cutthroat trout have intrinsic value as part of the native wildlife community (Behnke and Zarn 1976; Duff 1988) as well as value as sportfish (Duff 1988; Trotter 1987; Berg and Hepworth 1992).

Cutthroat trout are the only trout native to Utah, and they historically occurred within all major drainages in the state (Behnke 1988). Each of the three isolated drainages in Utah historically contained different native subspecies of *O. clarki*; however, the range and numbers of populations have since been reduced. Experts attribute the decline and/or loss of cutthroat trout subspecies to impacts from commercial and private harvesting, interactions with nonnative fish, such as hybridization and predation, and to habitat loss, degradation and range fragmentation caused through a variety of land uses and water development projects (Behnke and Zarn 1976; Binns 1977; Martinez 1988; Young 1995).

The three cutthroat trout subspecies native to Utah are: Bonneville (*Oncorhynchus clarki utah*), Colorado River cutthroat trout (*O.c. pleuriticus*) (CRCT), and the Yellowstone cutthroat trout (*O.c. bouvieri*) (YCT). Historically (before mid-1800's), BCT occurred in most high elevation streams and lakes within the Bonneville Basin, and CRCT occurred in high elevation streams and lakes of the Colorado River drainage. Although reduced in range and numbers, pure populations of the BCT and CRCT still exist within limited parts of their historic range. YCT historically occurred in the Raft River drainage (a small portion of the Snake River drainage) in northwest Utah. Recent surveys, however, did not reveal any pure populations of YCT.

During early settlement of Utah, cutthroat trout were exploited through private and commercial fishing. An extensive reduction in numbers of native trout in Utah led to protective legislation for trout as early as 1874 (Utah Territorial Legislation of 1874). Traditionally, cutthroat trout management actions included the use of fishing regulations and stocking programs to protect native cutthroat trout. However, as these methods failed to provide adequate protection and as the importance of preserving genetic integrity increased, management efforts began to focus on the ecology and conservation of the subspecies of cutthroat trout. Furthermore, management and protection of native cutthroat trout has been elevated, particularly in the last two decades, through increased public conservation awareness and increased sportfish demand. Protection and conservation of native cutthroat trout not only provides sportfishing opportunity but, in light of pressures of habitat loss and nonnative fish introductions, is necessary to ensure the natural long-term persistence of cutthroat trout subspecies in Utah.

Until February 28, 1996, BCT and CRCT were considered candidate species for federal listing (Notice of Review 1980; 45 FR 19857 for BCT and Notice of Review 1982; 47 FR 58454 for CRCT). BCT and CRCT are currently considered species of special concern by the State of Utah and are considered 'sensitive' by the U.S. Forest Service. YCT is afforded no special status in Utah.

BCT SYSTEMATICS

BCT probably evolved as the top predator of minnows, suckers and whitefish predecessors in ancient Lake Bonneville. With desiccation of the large pluvial lake, cutthroat trout diversified among remaining lakes and into upstream reaches of lake tributaries. In historical (mid 1800's) times, only Panguitch Lake, Utah Lake, and Bear Lake retained lacustrine populations, and most streams with adequate habitat retained fluvial BCT populations. Currently, all natural lake populations except that of Bear Lake are extinct, and stream populations are mainly restricted to isolated headwater reaches.

Researchers have not reached consensus on the evolutionary history of BCT. Behnke (1979, 1992) postulated that cutthroat trout may have gained access to the Bonneville Basin at multiple times during past geologic events. Thus, some differences are evident between Bear River, Bear Lake, Sevier Valley and other BCT types. Behnke (1992) categorized BCT into three types based on slight variations in meristic characteristics: (1) a type from the Bear River drainage of northern Utah, southeast Idaho, and southwest Wyoming; (2) the Snake Valley type from the region which borders Utah and Nevada; and (3) a type from the remaining Bonneville Basin drainages which includes the Ogden, Provo, Weber and Sevier River drainages.

Loudenslager and Gall (1980) also discussed the ancestry of BCT. They theorized that CRCT and BCT are closely related and share a common ancestor but that Bear River BCT represent a subsequent invasion of YCT into the Bonneville Basin. Therefore, the Bear River BCT might be a subgroup of the YCT subspecies. Limited mitochondrial DNA (mtDNA) analysis of BCT by Williams and Shiozawa (1989) supported the idea of diverse origins or multiple, independent mtDNA mutations in the basin. Later, Shiozawa et al. (1993) categorized BCT into three types different from Behnke (1992). The subgroups were: (1) the Bear River type, (2) the Southern Bonneville type (from the Virgin River drainage), and (3) the main Bonneville Basin type.

Using protein electrophoresis, Wydoski et al. (1976) discovered a unique enzyme characteristic in BCT from the Snake Valley area, providing evidence of genetic isolation and divergence within that group. Loudenslager and Gall (1980) also detected genetic divergence among groups of BCT using protein electrophoresis. These fish were separated into two groups: the Bear River type (Bear River drainage only) and Snake Valley type. Within these groups, the Bear River type was more similar to YCT than to BCT found elsewhere, while the Snake Valley type was more similar to CRCT than to the Bear River type. In addition, Martin et al. (1985) determined that Bear River cutthroat trout were distinct from all other BCT using protein electrophoresis which further confirmed the similarities between the Bear River type BCT and YCT.

Because of the diverse nature of the BCT subspecies, more work is required before phylogeny and intraspecific relationships can be accurately interpreted (See review in Schmidt *et al.* 1995). However, immediate attention is needed to conserve BCT as a subspecies in Utah. Behnke and Zarn (1976) advise that the various existing types should be considered unique and should not be genetically mixed. Based on current knowledge and for purposes of this Strategy, all types will be considered BCT; however, mixing of BCT types among geographic units and distinct drainages will be completely avoided except in extraordinary circumstances.

BCT generally have large, evenly distributed spots, but individuals exhibit wide variation. Coloration is generally dull. Vertebrae typically number 62-63. Scales in lateral series average 150-170 with the lowest number found in the Snake Valley type of BCT and the highest number found in Bear River type of BCT. Pyloric caeca number between 25-55 with an average of 35. BCT average between 16-21 gill rakers (18-19 in Bear River type and 20-21 in Snake Valley type). Another important characteristic is the presence of basibranchial teeth which are absent in rainbow trout (Behnke 1992).

BCT LIFE HISTORY

May et al. (1978) found that BCT sexually mature during the second year for males and the third year for females. Both the age at maturity and the annual timing of spawning vary geographically with elevation, temperature and life history strategy (Behnke 1992; Kershner 1995). Lake resident trout may begin spawning at two years and usually continue throughout their lives, while adfluvial individuals may not spawn for several years (e.g. Kershner 1995). Annual spawning of BCT usually occurs during the spring and early summer at higher elevations (Behnke 1993) at temperatures ranging from 4-10°C (May et al. 1978). May et al. (1978) reported BCT spawning in Birch Creek, Utah beginning in May and continuing into June. BCT in Bear Lake began spawning in late April and completed spawning in June (Nielson and Lentsch 1988). The wild broodstock at Manning Meadow Reservoir (9,500 ft. elevation) spawn from late June to early July (Hepworth and Ottenbacher 1995).

Typical of most trout, BCT require relatively cool, well oxygenated, water and the presence of clean, well sorted gravels with minimal fine sediments for successful spawning. Kershner (USFS, personal communication) found substrate size to be proportional to body size. For example, large adfluvial BCT typically spawn in large gravels or cobbles, while smaller, stream resident BCT spawn over coarse sand or small gravels.

Little information exists to document fecundity of wild BCT however, trout fecundity is typically between 1800-2000 eggs per kilogram of bodyweight (Behnke 1992). Incubation times for wild BCT have not been verified but may be approximated from other wild cutthroat trout such as YCT that average 30 days of incubation (Gresswell and Varley 1988). In general, growth of trout tends to be slower in high elevation headwater drainages than in lentic environments however, growth and reproductive rates of BCT depend greatly on stream productivity and habitat conditions. For more detailed life history information, see the BCT review by Kershner (1995).

STATE-WIDE MANAGEMENT

CONSERVATION

The primary goal of BCT cutthroat trout management in Utah is to conserve populations within significant portions of their historic range to ensure their continued existence. Actions to conserve these populations will be based on principles of conservation biology (Soule' and Wilcox 1980). Generally, important factors for the long-term conservation of species include: metapopulation dynamics, conservation genetics and habitat restoration and preservation. Furthermore, loss of one species from a community can precipitate extinction of coexisting species, if they are strongly interdependent (Terbough 1976; Gilbert 1980). Hence, a sound conservation ethic in management not only supports the persistence of BCT but also promotes ecosystem health.

Metapopulations and Genetic Integrity:

Although individual populations should be managed and protected, some degree of interconnectedness among populations is also needed to maintain genetic exchange and stabilize population dynamics over time (Wilcox and Murphy 1985, Hanski and Gilpin 1991). In fact, metapopulation persistence depends on the temporal and spatial dynamics of local populations connected through unobstructed migratory corridors (Wilcox and Murphy 1985; e.g. Gilpin and Hanski 1991).

Metapopulations stabilize local population dynamics in several ways: 1) migration of individuals allows genetic exchange among local populations thereby increasing genetic heterogeneity (Simberloff and Abele 1976); 2) large, interconnected populations are less vulnerable to losses incurred through environmental and demographic stochasticity (Roff 1974; Wilcox and Murphy 1985); 3) large, interconnected populations are more resistant to changes in deterministic variables that dictate population stability, such as birth and survival rates (e.g. Connell and Sousa 1983; Rieman and McIntyre 1993).

Managing for genetic integrity within BCT populations requires understanding the genetic basis of variation for phenotypes of traits that are ecologically and evolutionarily important (e.g. behavior, morphology, physiology) (Allendorf 1995). Geneticists focus on describing molecular variation because of simplicity in interpreting the genetic foundation. Although the relationship between the molecular genetics and phenotypic traits of the organism is often complex, this genetic variation underlies the adaptive phenotypic variation that is the object of preservation in all conservation efforts. As such, genetic information is an essential component to making sound conservation decisions.

In the Bonneville Basin, some potential exists for restoration and/or enhancement of genetically pure populations and metapopulations. BCT conservation management will focus on restoring and/or preserving ecosystem processes in these areas to ensure a persistent and more natural ecological and evolutionary future for BCT in Utah.

Current Status and Distribution:

Researchers speculate that historically BCT inhabited all systems in the Bonneville Basin with suitable habitat (Hickman 1978; Hickman and Duff 1978; Duff 1988; Behnke 1992). However, in the last one hundred years, human land use and stream alterations have restricted BCT range through loss of connectivity among populations and loss and degradation of suitable habitat.

Recently, it has been suggested that most BCT populations are confined to small headwater streams above natural barriers (Hickman 1978). Presently, a total of 40 known BCT populations occupy approximately 147.4 stream miles and 35,108 surface acres of lentic water throughout regions of Utah. These and numerous additional cutthroat populations are awaiting genetic and meristic analysis to determine subspecies purity. Because of ongoing BCT conservation and sportfishing management, the future of this subspecies is more promising now than it was in the 1970s.

Behnke (1976) made one of the first references to recovering BCT in Utah. He suggested that individuals from two populations in the Virgin River drainage (Water Canyon and Reservoir Canyon) and one in the Sevier River drainage (Birch Creek) should be transplanted into new areas to expand BCT range. Also, after identifying pure strains of BCT in the Snake River Valley portion of Utah, Behnke (1976) suggested additional pure populations of BCT existed and could be located with additional surveys.

Soon afterwards, Hickman (1978) documented 15 populations of potentially pure BCT in Utah, Nevada and Wyoming. The discovery of these populations prompted more surveys; consequently, BCT were found in areas throughout the Bonneville Basin including the Sevier and Jordan River drainages.

In 1979, the American Fisheries Society (AFS) designated BCT as "threatened" throughout its range because of present and/or potential habitat destruction from poor land use practices and because of hybridization and competition with nonnative species (Deacon et al. 1979). Ten years later, the AFS reclassified BCT as "endangered" after more information revealed that BCT range was severely restricted (Williams et al. 1989). In addition, BCT was considered a candidate species for federal listing (Notice of Review 1980; 45 FR 19857) until legislative changes on February 28, 1996. The State of Utah currently considers BCT as a species of special concern (S1), and the U.S. Forest Service and the BLM consider BCT as 'sensitive'.

In addition to protective legislation, the USFWS, the USFS, BLM, and the State of Utah have initiated stream improvement projects, population and habitat surveys, brood stock development and reintroductions over the past decade. These efforts allowed managers to expand known BCT range since the 1970's. As a result, the status of BCT in Utah has improved in some areas and is considered by some to be stable overall. However, BCT conservation requires removal of threats to its present and future persistence.

Problems Facing the Species:

The success of any conservation or recovery program depends on eliminating or reducing the impact of activities that threaten the species existence. The following list of threats to BCT in the State of Utah is based on the five criteria considered for federal listing of a species in Section 4(a)(1) of the Endangered Species Act of 1973, as amended. Under each of these criteria, specific activities threatening the persistence of BCT populations are described. Threats unique or extreme to drainages are discussed within individual GMUs.

(1) The present or potential destruction, modification, or curtailment of habitat or range (HABITAT DEGRADATION).

The FWS Notice of review (1980) identified poorly managed water development, livestock grazing, energy development, and mining as primary threats to BCT habitat. Poorly planned timber management and associated road building can also degrade BCT habitat.

- (a) Water development or diversion of stream flows which altered natural flow patterns has been one of the greatest causes of habitat loss. Water development has altered historic flow timing, duration and magnitude or completely dewatered stream segments.
- (b) Past and some current livestock grazing practices adversely impact BCT and their habitat. Poor grazing practices can alter sediment transport regimes and streambank stability and can change water quality, substrate composition and channel structure. Specific ramifications include loss of pool habitat, reduced instream cover, increased water temperature, and loss of quality substrate required for spawning and food production.
- (c) To date, energy development and mining activities have had effects in some areas, and impacts have been localized. Potential threats include mine tailing leaching, especially during spring runoff, road building with associated sedimentation and migration corridor blockage, and water depletions for dust control, maintenance activities, and fossil fuel exploration.
- (d) Habitat fragmentation is a significant threat to the persistence of BCT in Utah. Fragmentation prevents gene exchange among populations and limits access to preferred or necessary habitats which ultimately threatens population viability.

2) Disease, predation, competition and hybridization (DETRIMENTAL INTERACTIONS)

- a) The recent introduction of whirling disease into Utah river systems poses the greatest disease threat. The parasites pleistophora and epitheliocystis have been found in the Bonneville Basin drainages as well. BCT may be more vulnerable to disease and parasites when exposed to adverse conditions and unnatural or human induced forces.
- b) Predation is a potential threat (especially to early life stages) where other predaceous fish occupy the same area as BCT.
- c) Several studies suggest that introduced salmonids will competitively replace native cutthroat species (Griffith 1988; Kershner 1995). However, the extent to which competition is a threat has not been thoroughly assessed.
- d) Because both native (Behnke 1992) and nonnative (Duff 1988) salmonids have been stocked throughout Utah, hybridization poses a significant threat to the genetic integrity of BCT populations. BCT can hybridize with rainbow trout and other cutthroat subspecies in some situations. Hybridization with nonnative fish leads to an eventual swamping of the native BCT genotype. Hybridization among cutthroat trout subspecies can result in the loss of the characteristic BCT phenotype (Kershner 1995).

3) Over harvesting for commercial, recreational, scientific, or educational purposes (OVERUTILIZATION).

Over fishing is a potential threat in highly accessible areas where BCT are found. Unrestricted angling can effectively displace cutthroat trout populations where they coexist with other salmonids, because cutthroat trout are generally easier to catch (Behnke 1992). Binns (1981) also noted that BCT were easy to catch but that catchability was variable. The FWS includes overharvesting by sportfish anglers as an existing threat; however, the State of Utah currently enforces angling restrictions in portions of BCT range to protect this subspecies (Nielson and Lentsch 1988). This threat is considered excessive in some areas in the State of Utah, and fishing impacts should be assessed to ensure adequate protection of BCT. In addition, removing too many individuals from small populations for scientific or management purposes could have similar impacts.

4) Inadequate regulatory mechanisms (INADEQUATE REGULATION).

Although management has improved and the onset of BCT conservation has lead to BCT angling regulation, inadequate regulatory mechanisms probably contributed to the decline of BCT populations historically and remains a threat in some areas.

5) Other natural or human induced factors affecting the continued existence of BCT (OTHER FACTORS)

- a) Natural climatic events such as flood, fire and drought may threaten specific populations of BCT; however, these forces pose threats as long as BCT range remains fragmented and populations are small and when they are combined with other poor land use practices, such as overgrazing or some timber harvests. Small, isolated populations are more susceptible to catastrophic loss and impacts from demographic stochasticity.
- b) One of the most imposing threats to the persistence of BCT at this time is the socio-political pressure associated with managing a species recognized as sensitive by state and federal agencies. Existing or potential sensitive recognition has endowed BCT with a perceived status which elicits public and governmental resistance to BCT management. This socio-political pressure can block conservation efforts at the state and local levels.

Goal:

Ensure the persistence and genetic integrity of the BCT within its natural range in Utah.

Objectives:

Current BCT populations are mainly restricted to headwaters (1st order streams) which often reflect habitat refugia rather than habitat preference; therefore, objectives to meet the goal of this program will be based on historically occupied miles of stream categorized by stream order. This format ensures that conservation actions are not limited to headwater streams and that all historical stream and watershed types are represented in future conservation efforts. Waters will be categorized from 1st order (headwaters) to 5th and higher order streams and lakes (lentic environments) and stream mileage will be determined and summarized by stream order from 1:100,000 scaled maps of drainages. Until historic stream miles by stream order are summarized, goals are summarized by major drainages within GMU's.

The following two objectives will be required to attain the goal of this strategy:

- 1) Restore and maintain 62 conservation populations of BCT throughout 332.1 stream miles and 35,775 surface acres including a sufficient number of metapopulations within five GMUs (Table 1).

By GMU, the proposed objectives are to:

- a) Maintain 3 populations and 12 occupied stream miles and 35,000 surface acres of lentic water in the Bear Lake Bonneville GMU. This includes only the Utah portion of Bear Lake.
 - b) Maintain 20 populations and 79 occupied stream miles and 75 surface acres of lentic water in the Bear River Bonneville GMU.
 - c) Maintain 15 populations and 119.4 occupied stream miles and 700 surface acres of lentic water in the Northern Bonneville GMU.
 - d) Maintain 10 populations and 61.7 occupied stream miles in the West Desert GMU.
 - e) Maintain 14 populations and 60 occupied stream miles and 73 surface acres of lentic water in the Southern Bonneville GMU.
- 2) To eliminate or minimize threats to BCT and its habitat to the greatest extent possible.

Actions:

The following section outlines a general list of actions that eliminate or reduce threats to BCT persistence. Each general action includes a list of specific actions which may be implemented. Because the potential for BCT restoration varies among GMUs, actions will be prioritized and implemented within GMUs.

- 1) **Determine baseline BCT population, life history and habitat data (ADDITIONAL SURVEYS).**
 - a) Locate and assess additional BCT populations and confirm known population status.
 - b) Analyze habitat fragmentation to determine the degree of connectedness required for metapopulation persistence.
 - c) Identify additional BCT habitat and life-history requirements and conditions through surveys and studies of hydrologic, hydraulic, biologic and watershed features.
 - i) flow quantity, timing, and duration;
 - ii) riffle to pool ratios and substrate size and composition;
 - iii) sympatry and macroinvertebrate community composition and ecology and
 - iv) water quality, riparian condition, percent coarse woody debris and percent undercut bank.

- d) Determine the number of individuals and habitat requirements needed to maintain a conservation population.

2) Determine and maintain genetic integrity (GENETIC ANALYSIS).

- a) Improve and refine identification techniques for BCT. In addition to using traditional meristic approaches, protein electrophoresis, mitochondrial DNA, nuclear DNA, and other techniques may need to be developed and employed.
- b) Conduct genetic surveys of BCT populations within GMUs. Confirm status of known pure and determine status of potentially pure BCT populations.
- c) Establish introduction, reintroduction and transplant protocols based on criteria of maximizing genetic integrity among GMU's (minimizing mixing of types) and maximizing genetic variability within populations. (Also see 5-a and 5-c)

3) Enhance and maintain habitat (HABITAT ENHANCEMENT).

- a) Enhance and/or restore connectedness and opportunities for migration to disjunct populations where possible. Migratory corridors should retain some degree of their natural physical and biological condition to enable migration and gene flow.
- b) Enhance and/or restore habitat conditions in designated waters throughout the range of BCT. Actions may include bank stabilization and runoff control structures, road closure and restoration or road relocation, riparian fencing and sustainable grazing practices.
- c) Maintain and restore where possible natural hydrologic characteristics such as flow quantity, timing and duration to maintain active channel and floodplain features (e.g. riparian vegetation, undercut bank, bed structure and sediment transport regimes). This action includes securing instream flow needs through water acquisition or regulation.

4) Selectively control nonnative species (NONNATIVE CONTROL).

- a) Determine where detrimental interactions, such as hybridization, competition and disease occur or could occur between BCT and sympatric nonnative species.
- b) Control or modify stocking, introductions, spread of nonnative aquatic species where appropriate. Implement measures to ensure the spread of disease (i.e. whirling disease) is prevented through disease certification and adequate stocking and fishing regulation.

- c) Eradicate or control detrimental nonnative fish where feasible. Targeted species may include brook trout, rainbow trout, brown trout and some hybrid populations. This action includes construction of fish barriers to prevent nonnative fish movement where presence of nonnative species preclude reestablishment of migratory corridors. This action also includes the limited use of piscicides (i.e. rotenone) to remove competing or hybridizing nonnative salmonids with intent to restore and maintain BCT populations in drainages within their natural range. Standard procedure for chemical stream treatment will include investigation of the feasibility and effectiveness of post-treatment macroinvertebrate community restoration.
- 5) Expand BCT populations and distribution through introduction or reintroduction from either transplanted or broodstock BCT raised in a designated hatchery (REINTRODUCTION).**
- a) Establish protocols and criteria for introduction and reintroduction of BCT based on conservation objectives or sportfishing objectives (See 2-c).
 - b) Identify and develop brood stock sources including identification of wild sources, disease certification, rearing facilities, and protocols for taking wild fish and eggs.
 - c) Restore BCT populations into appropriate streams/lakes. Where feasible, identify areas to restore BCT metapopulations (See 2-c).
 - d) Establish a BCT hatchery program within the state hatchery program that will be responsible for cultivation of BCT to be used in introduction, reintroduction and stocking programs for conservation and sportfishing populations.
- 6) Monitor Populations and Habitat (MONITORING).**
- a) Develop and implement BCT population and habitat monitoring protocol to determine program effectiveness. Parties responsible (as designated by the BBCRT) for administering and conducting monitoring are described in Table 3 of the Agreement.
 - b) Evaluate conditions of populations and habitats using baseline data (See 1-a).
- 7) Develop a mitigation protocol for proposed water development and future habitat alteration, where needed.**

SPORTFISHING

This program encourages the promotion and use of BCT as a sportfish within the State of Utah. Promotion of BCT as an alternative sportfish to nonnative salmonids has occurred to a limited extent for 15 years, mainly in the Southern Bonneville GMU. Currently, a stocking protocol is being established in the State of Utah in which future BCT stocking will gradually replace stocking of nonnative salmonids (i.e. rainbow trout) into appropriate waters within the historic range of BCT in Utah. This transition will occur as BCT brood sources become available and as artificial BCT culturing becomes feasible and effective within the state hatchery program for purposes of stocking (i.e. adequate numbers are reared and survival in the wild can be expected). The exception to replacing nonnative salmonid stocking with BCT stocking is in waters that receive high fishing pressure where supplemental stocking of rainbow and other trout may be deemed necessary to meet public sportfishing demands. Such exceptions will occur only if the demands do not conflict with meeting BCT Conservation goals and objectives. Areas that are currently expected to be exceptions under this criterion are considered urban or near-urban streams and reservoirs with good public access and high use impacts.

As noted in the description of conceptual management of sportfishing populations, BCT will be managed first for conservation and long-term protection of the BCT in Utah and second as a sportfish. Goals and objectives described in the sportfish section will be implemented to supplement Conservation management, not to replace them. Achievement of Sportfishing goals and objectives will not conflict with Conservation management. Any quantitative Sportfishing objectives identified in this section are in addition to, and not conflicting with, the priority of meeting Conservation objectives.

At this early stage in program implementation, most Sportfishing objectives are pending completion of Conservation objectives. In the future, we expect that Sportfishing objectives will increase as the sportfish popularity of BCT increases and as BCT status improves to a naturally viable level. As areas become identified for stocking of BCT for supplemental sportfishing purposes, waters will be specifically identified within this program.

Goal:

Utilize BCT in routine management of sportfish recreation.

Objectives:

1. In the Bear Lake GMU, the Sportfishing objectives currently proposed are:
 - a) Maintain 4 occupied stream miles in Bear Lake tributaries.

Additional Sportfishing populations may be determined as Conservation objectives are met.

2. In the Bear River GMU, no quantitative Sportfish objectives are currently proposed but may be determined after more information about status of BCT in many drainages is ascertained and the Conservation objectives are met.
3. In the Northern Bonneville GMU, by drainage, the Sportfishing objectives currently proposed are to:
 - a) Maintain 2 populations and 30.2 occupied stream miles and 350 surface acres of lentic water in the Jordan River drainage.
 - b) Maintain 2 populations and 33 occupied stream miles in the Utah Lake/ Provo River drainage.
4. In the West Desert GMU, no quantitative Sportfish objectives are currently proposed but may be determined after Conservation objectives are met.
5. In the Southern Bonneville GMU, by drainage, the Sportfishing objectives currently proposed are to:
 - a) Maintain 30 occupied stream miles and 250 surface acres of lentic water in the Virgin River drainage.
 - b) Maintain 30 occupied stream miles and 1100 surface acres of lentic water in the Beaver River drainage.
 - c) Maintain 50 occupied stream miles and 1430 surface acres of lentic water in the Sevier River drainage.

Actions:

Actions implemented for the purpose of meeting Sportfishing objectives may be, but are not limited to, actions described for meeting Conservation objectives. Sportfish populations may be managed without constraint within the State sportfishing program unless (1) activities or consequences of activities to manage sportfishing populations conflict with Conservation goals and objectives or (2) threats to long-term BCT persistence within its natural range in Utah are perpetuated or increased by sportfishing actions or consequences of these actions.

GMU CONSERVATION AND MANAGEMENT

BEAR LAKE MANAGEMENT UNIT

Unit description:

Bear Lake is a natural lake that is at least 23,000 years old. It covers 70,000 surface acres and averages 80 feet deep. Bear Lake is bisected by the Utah-Idaho state line. Historically, Bear Lake was an oligotrophic, nitrogen limited, terminal lake with a pH exceeding 8.0. However, diversion of the Bear River into Bear Lake for irrigation water storage since 1917 is altering Bear Lake chemistry. Bear Lake's native fish community includes a lacustrine form of BCT that is piscivorous and relatively long lived (Nielson and Lentsch 1988). In addition, the lake contains four endemic species of whitefish, cisco and sculpin.

Current Status and Distribution:

Currently, 2 populations of BCT occupy 12 stream miles and 35,000 surface acres in this GMU (Table 4). Typically, Bear Lake BCT ascend tributary streams to spawn and then return to the lake. Fry and fingerlings may spend up to two years in the stream before moving into Bear Lake.

Table 4: Status of BCT within Bear Lake GMU. OSM = occupied stream miles/surface acres (sa). 'pure' = genetically pure; 'potentially pure' = awaiting genetic analysis. ? = status unknown. sa = surface acres of lentic water. (See Definitions)

State Water ID #	Reach	BCT Status	OSM
IVAQ405	Bear Lake	pure (Bear Lake BCT)	35,000 sa
IVAQ120B	Swan Creek	hybrid	
IVAQ120C	Big Spring Cr.	spawning tributary	4
IVAQ120D	Laketown Cr.	?	
IVAQ120F	North Eden Cr.	pure (Bear River BCT)	8

Threats:

- 1) ***Habitat Degradation:*** The major threat in this unit is loss of habitat due to water development. Water development includes irrigation diversions and canals that dewater lake tributaries, particularly in spawning areas.

Logging, road building and grazing currently do not impact BCT populations in the Bear Lake ecosystem. The one possible exception is in North Eden Creek. However, habitat conditions should be monitored for impacts from land use practices.

- 2) ***Over utilization:*** Recreational fishing is closely monitored and not likely to have a negative impact on the BCT populations in this unit. However, monitoring of fishing should continue as Over harvesting is a potential threat.

- 3) ***Inadequate regulation:*** Regulations and laws regarding use, rights, and consumption of Bear Lake water also pose a threat to BCT habitat and subsequently to BCT populations and range. The upper 21 feet of Bear Lake is used as an irrigational reservoir. Extreme irrigation drawdowns can severely impact BCT's ability to ascend tributaries during spawning and can limit availability of littoral zone habitats used by juvenile cutthroat trout.

Conservation Objectives:

The Conservation Objectives for the Bear Lake Unit are to maintain 3 populations within 12 stream miles and 35,000 surface acres of occupied BCT habitat. By drainage, the unit objectives proposed are to:

- 1) Maintain 2 populations of Bear River BCT throughout 12 tributary stream miles.
- 2) Maintain the lacustrine Bear Lake population over 35,000 surface acres.

Sportfishing Objectives:

At this time, Sportfishing Activities for the Bear Lake GMU are to:

- 1) Maintain 4 occupied stream miles in Bear Lake tributaries.

These objectives may increase as conservation objectives are met. Objectives for sportfishing in the Bear Lake GMU are directed at providing a trophy Bear Lake BCT fishery in concert with the endemic fish populations. Catch and release or consumptive harvest (depending on site) fishing in tributaries will be maintained. Spawning access improvement and juvenile rearing areas on Big Spring Creek and North Eden Creek will also be implemented. At this time, managers do not perceive establishment of additional populations beyond that identified within conservation objectives until these objectives are met, however potential exists for establishment of additional BCT populations with program progress.

Actions:

- 1) ***Habitat enhancement:*** Conservation actions in this area will focus on managing aspects of water development within the confines of water law and should be directed at acquiring minimum instream flow needs, screening diversions and minimizing periods of dewatering through water management. A minimum lake level and agreements with PacifiCorp and downstream water users will hopefully minimize problems associated with lake drawdown in the future.
- 2) ***Additional surveys:*** Data collection on population trends of endemic fish, habitat and interactions between BCT types found in the tributaries will continue.
- 3) ***Nonnative control:*** Control or eradication of selected populations of nonnative species will be combined with stocking of sterile nonnative sportfish into Bear Lake. Nonnatives will not be stocked into tributaries.

- 4) ***Reintroduction:*** One population of Bear River BCT will be reintroduced into Laketown Creek to meet conservation objectives. In addition to limited natural reproduction, approximately 300,000 age-1 Bear Lake BCT are annually stocked into Bear Lake.

Table 5 outlines the time frame for implementing Conservation Actions in the Bear Lake GMU. Table 6 outlines the time frame for implementing Sportfishing Actions. Actions listed in these tables are sequential from left to right. Years refer to action initiation date.

Table 5: Conservation Actions to be implemented within the Bear Lake GMU.

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Bear Lake	1996					
Swan Creek tributary						
Big Springs Creek tributary			1998			1997
Laketown Creek tributary					1996	1997
North Eden Creek tributary						

Table 6: Sportfishing Actions to be implemented within the Bear Lake GMU.

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Bear Lake	1996					1996
Swan Creek tributary						
Big Springs Creek tributary			1997			
Laketown Creek tributary						
North Eden Creek tributary			1997			

BEAR RIVER MANAGEMENT UNIT

Unit Description:

This GMU is characterized by aspen and subalpine fir/spruce forests and willow dominated meadows. Lower elevations may be dominated by sagebrush communities. Elevation ranges from 5,000 to 11,000 feet. Stream gradient ranges from high gradient in canyon reaches to low gradient in meadows. Hydrology of streams are characterized by high spring runoff peaks during snowmelt and low to intermittent fall and winter base flows.

For management purposes, this GMU has been divided into three geographic subunits: 1) Uinta Mountains and Upper Bear River drainage, 2) Cache Valley drainages and 3) Rich County drainages.

Current Status and Distribution:

Currently, this GMU contains 15 pure populations within 59 stream miles and 8 potentially pure populations that need genetic analyses. Table 7 shows the status and distribution of BCT among drainages.

Table 7: Status of BCT within the Bear River GMU. OSM = occupied stream miles. 'pure' = genetically pure; 'potentially pure' = awaiting genetic analysis. sa = surface acres of lentic water. (See Definitions)

a) Uinta Mountains/ Upper Bear River

State Water ID #	Reach	BCT Status	OSM
IVAQ230 IVAQ230C IVAQ230E IVAQ230F IVAQ230B IVAQ230A	Drainage: Mill Creek - main Mill Creek - Carter Creek - McKenzie Creek - North Fork - Deadman Creek - Christmas Tree Creek (Cow Hollow?)	pure pure pure pure potentially pure potentially pure	12.5 2.5 4 3
IVAQ250 IVAQ250A IVAQ250Q IVAQ250P	Drainage: East Fork - main East Fork - Boundary Creek - Left Hand Fork - Right Hand Fork	potentially pure pure potentially pure potentially pure	3
IVAQ260 IVAQ260A	Drainage: Stillwater Fk. - Stillwater Fork - Main Fork	suspected hybrid potentially pure	
IVAQ270 IVAQ270A	Drainage: Hayden Fork - main Hayden Fork - Gold Hill Creek	suspected hybrid pure	3

IVAQ240O1	Drainage: West Fork	pure	2
IVAQ240B	- West Fork (above res.)	pure	5
IVAQ240C	- Mill City Creek	potentially pure	
IVAQ240D	- Humpy Creek	pure	3
IVAQ240A	- Meadow Creek	potentially pure	
	- Deer Creek		

b) Cache Valley

State Water ID #	Reach	BCT Status	OSM
IVAQ040A	Logan River	potentially pure	
IVAQ040AO701	- main Logan River	potentially pure	
IVAQ040AO8	- Right Hand Fork	potentially pure	
IVAQ040AO802	- Temple Fork	pure	4
IVAQ040A0901	- Spawn Creek	pure	0.5
IVAQ040A1001	- Bear Hollow (Twin Cr.)	potentially pure	
IVAQ040A1201	- West Hodges Creek	pure	1
IVAQ040A1301	- Little Bear Creek	potentially pure	
IVAQ040A1401	- Tony Grove Creek	potentially pure	
IVAQ040A1501	- Bunchgrass Creek	potentially pure	
IVAQ040A1601	- White Pine Creek	potentially pure	6.5
	- Beaver Creek	pure	
IVAQ040A2A	Blacksmith and Little Bear drainages	potentially pure	
IVAQ040A03A01	- main Blacksmith Fork	potentially pure	
	- Left Hand Fork	potentially pure	
IVAQ040D02	- headwater tributaries	potentially pure	
	- East Fk. of the Little Bear above Porcupine Reservoir	potentially pure	

c) Rich County

State Water ID #	Reach	BCT Status	OSM
IVAQ190	Big Creek drainage		
IVAQ200B	Woodruff Creek	pure	6
IVAQ20002	- Sugar Pine	potentially pure	
IVAQ20003	- below Woodruff Res.	potentially pure	
IV407	- above Woodruff Res.	potentially pure	
	- Woodruff Reservoir		
Private land	Deseret Land/Livestock	potentially pure	
	- Saleratus Reservoir		
	- Dip Reservoir		

Threats:

- 1) ***Inadequate Regulation:*** Much of the land on this GMU is privately owned, hence potential to implement conservation actions is limited.
- 2) ***Habitat Degradation:*** Poor grazing practices and water development(irrigation, dewatering and diversion structures) pose significant threats to BCT habitat. Impacts due to roads and road construction occur in all subdrainages. Other threats include poor timber harvest practices.
- 3) ***Detrimental Interactions:*** Nonnative fish have been stocked in many headwater lakes and accessible stream sections throughout the Bear River GMU. The extent to which hybridization and competition affect BCT conservation should be assessed.

The continued spread of whirling disease poses a potential threat to BCT populations in the Bear River GMU.

- 4) ***Over utilization:*** Fishing pressure can be extremely high along stream sections and lakes with direct public access and is increasing overall. Although not currently considered a primary threat, fishing pressure should be considered a potential threat in high use areas.

Conservation Objectives:

The conservation objectives for the Bear River Unit are to maintain 24 populations within 57 stream miles and 75 surface acres of lentic water.

By drainage, the unit Objectives proposed are to:

- 1) Maintain 14 populations and 45 occupied stream miles in the Uinta/Upper Bear River subunit.
- 2) Maintain 8 populations and 30 occupied stream miles in the Cache County subunit.
- 3) Maintain 2 populations and 12 occupied stream miles in the Rich County subunit and 75 surface acres of lentic water.

Sportfishing Objectives:

Management activities for this GMU are pending completion of conservation objectives.

Actions:

- 1) ***Habitat enhancement:*** Actions should include identification of private lands available for conservation easements in appropriate areas and development of funding sources for easements and incentives.

In some areas, habitat restoration will offset negative effects of grazing, timber, roads and water development in riparian areas.

Attempts should be made to maintain minimum flows and construct fish passage structures or screen diversion intakes where possible.

Small blocks of private land that are surrounded by public lands within BCT range present an opportunity for land acquisition which may prevent future development and loss of conservation populations to some extent in these and surrounding areas.

- 2) ***Nonnative control:*** To prevent the spread of whirling disease, actions include prevention of illegal stocking and increased public education.

Also, actions will include termination of nonnative cutthroat or fertile rainbow trout stocking in waters with confirmed populations of native cutthroat.

- 3) ***Reintroduction:*** A brood source for hatchery rearing and stocking of BCT must be developed. One potential broodstock and rearing site is the population of transplanted Sugar Pine Creek BCT in ponds at the Deseret Land and Livestock Ranch (DLLR).

Table 8 outlines the time frame for implementing Conservation Actions in the Bear River GMU. Actions listed in these tables are sequential from left to right. Years refer to action initiation date.

Table 8: Conservation Actions to be Implemented within the Bear River GMU.

a) Upper Bear River subunit

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Drainage: Mill Creek - main Mill Creek - Carter Creek - McKenzie Creek - North Fork - other tributaries	1996	1996	1996-98 1998 1998			1999
Drainage: East Fork - main East Fork - Boundary Creek - Left Hand Fork - Right Hand Fork	1997 1997	1997 1997				
Drainage: Stillwater Fork - Stillwater Fork - Main Fork		1996 1996				
Drainage: Hayden Fork - Gold Hill Creek		1996				
Drainage: West Fork - West Fork (above res.) - West Fork (below res.) - Mill City Creek - Humpy Creek - Meadow Creek - Deer Creek	1998	1996 1998	1998			1999

b) Rich County subunit

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Big Creek drainage	1997	1998				
Woodruff Creek - Sugar Pine - below Woodruff Reservoir - above Woodruff Reservoir - Woodruff Reservoir	1996,97 1997	1996,97 1997				
Deseret Land/Livestock - Saleratus Reservoir - Dip Reservoir					1997	1996

c) Cache County subunit

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Logan River - main Logan River - Right Hand Fork - Temple Fork - Spawn Creek - Bear Hollow - West Hodges Creek - Little Bear Creek - Tony Grove Creek - Bunchgrass Creek - White Pine Creek - Beaver Creek			1996 1996 1996			
Blacksmith Fork River - main Blacksmith Fork R. - Left Hand Fork - headwater tributaries	1998 1998 1998	1998 1998 1998	1998,99			

NORTHERN BONNEVILLE MANAGEMENT UNIT

Unit Description:

The North Bonneville Management Unit ranges in elevation from 5,000 to approximately 10,000 feet. The vegetational community is characterized by high desert sagebrush at lower elevations, and aspen and subalpine fir/spruce communities at higher elevations. Riparian areas are generally dominated by willows or mountain maples and gamble oak. Stream gradient ranges from extremely high alpine streams to low gradient meadow meanders. Lower elevation areas have extensive agricultural and urban development whereas inaccessible high elevation areas tend to be more pristine. Habitat condition is highly variable among drainages and streams.

For management purposes, this GMU is divided into four management subunits: 1) the Ogden River drainage, 2) the Weber River drainage, 3) the Jordan River drainage, 4) the Utah Lake/Provo River drainage.

Current Status and Distribution:

Currently, this GMU contains 6 pure populations within 18.4 stream miles and 50 surface acres of lentic water. Numerous streams contain potentially pure populations and are awaiting genetic analyses. Table 9 shows the status and distribution of BCT among drainages.

Table 9: Status of BCT within the Northern Bonneville GMU. OSM = occupied stream miles. 'pure' = genetically pure; 'potentially pure' = awaiting genetic analysis. ? = status unknown. sa = surface acres of lentic water. (See Definitions)

a) Ogden River drainage

State Water ID #	Reach	BCT Status	OSM
IVAP030D0601	Ogden River	potentially pure	
	- Cutler Creek	potentially pure	
IVAP030C	- Cobble Creek	potentially pure	
IVAP030B0301	- Middle Fork	potentially pure	
IVAP030B0301	- Wheat Grass Creek	potentially pure	
IVAP030B0501	- Left Hand Fk of S.F.	potentially pure	
IVAP030B0401	- Right Hand Fk of S.F.	potentially pure	

b) Weber River drainage

State Water ID #	Reach	BCT Status	OSM
IVAP080A01	Lower Weber River	potentially pure	
IVAP070A01	- Arbuckle Creek	potentially pure	
IVAP100	- Gordon Creek	potentially pure	
IVAP06001	- Dalton Creek	potentially pure	
IVAP090	- Strawberry Creek	potentially pure	
IVAP130	- Peterson Creek	potentially pure	
	- Line Creek	potentially pure	

IVAP150A0201 IVAP150A0401 IVAP330E01 IVAP150A0601 IVAP150L01 IVAP150O01 IVAP150P01 IVAP150Q01	East Canyon Creek - Arthur Fork - Walton Creek - Shingle Mill Creek - Farrels Creek - Big Bear Creek - Toll Creek - Two Mile Creek - Three Mile Creek	potentially pure potentially pure potentially pure potentially pure potentially pure potentially pure potentially pure potentially pure	
IVAP180G01 IVAP180C01 IVAP180D01 IVAP180F01	Lost Creek - Blue Fork Creek - Guildersleeve Creek - Hell Canyon - Killfoil Creek	potentially pure potentially pure potentially pure potentially pure	
IVAP210A01	Echo Creek - Sawmill Creek	potentially pure	
IVAP23002	Chalk Creek - East Fork Chalk Creek	potentially pure	
IVAP38001 IVAP39001 IVAP41001 IVAP450A01 IVAP35001 IVAP400 IVAP430 IVAP330	Upper Weber River - Bob Young Creek - Stillman Creek - Red Creek - Gardners Creek - South Fk of Weber - Smith Morehouse Cr. - Moffitt Creek - Beaver Cr. tribs. - other tributaries	potentially pure potentially pure potentially pure potentially pure potentially pure potentially pure pure potentially pure potentially pure	6

c) Jordan River drainage

State Water ID #	Reach	BCT Status	OSM
IVAA010 IVAA020 IV416 IVAA030 IVAA040 IVAA040B IV414A IVAA040A IV414B IVAA050 IVAA09001	Jordan River - City Creek - Red Butte Creek - Red Butte Reservoir - Emigration Canyon Cr. - Parley's Canyon Creek - Lamb's Canyon Creek - Mtn Dell Reservoir - Mtn Dell Creek - Little Dell Reservoir - Mill Creek (SLC) - Bell Creek - Deaf Smith Creek	potentially pure pure pure potentially pure potentially pure potentially pure potentially pure pure potentially pure potentially pure pure	8.4 50 sa 3

d) Utah Lake/ Provo River drainage

State Water ID #	Reach	BCT Status	OSM
VAA VAE010 VAE	Wasatch Front - Dry Creek - Grove Creek - Battle Creek		
VAB020	American Fork River - North Fork	potentially pure	
VAF01 VAF070 VAF020 VAQ08002	Provo River - lower Provo River - Bench Creek - Little South Fork - Willow Creek	pure potentially pure potentially pure potentially pure	1
VAJ020E01	Hobble Creek - Wardsworth Creek	potentially pure	
VAK020H0101 VAD020H01 VAK040F VAK020J01 VAK020J0101 VAK020J01A01 VAK040A VAK040I01 VAK040I0101 VAK040	Spanish Fork - Fifth Water - Sixth Water - Tie Fork - Hall's Fork - Chases Creek - Shingle Mill Creek - Lake Fork Creek - So. Fk. Soldier Creek - Bennion Creek - Soldier Creek	potentially pure potentially pure potentially pure potentially pure potentially pure potentially pure potentially pure potentially pure potentially pure potentially pure potentially pure	

VAK030E01 VAK030E04 II783	Thistle Creek - Nebo Creek - Holman Creek - Strawberry Reservoir	potentially pure potentially pure ?	
VAN	Santaquin Creek	potentially pure	

Threats:

- 1) ***Habitat degradation:*** Habitat degradation from water development (e.g. diversions and dams), stream alterations (e.g. channelization, barriers etc.) road construction, grazing, and nonnative stocking is a significant threat in this GMU.

Fragmentation is probably the greatest threat on this unit. Diversion structures fragment populations and make headwater spawning streams inaccessible to migrating BCT.

Low numbers of populations and small populations sizes limit potential range expansion through transplant populations.

- 2) ***Over utilization:*** Recreational fishing is a potential threat in areas accessible to public; however, many stream sections are private and access is limited.
- 3) ***Detrimental interactions:*** Spread of disease through illegal introductions of fish is a potential threat. To date, the extent of this threat remains unclear but should be assessed.

Nonnatives have also impacted BCT through predation, competition, and hybridization with rainbow trout. Rainbow trout fisheries popular with the public will be difficult to control.

- 4) ***Inadequate regulation:*** Regulations and laws regarding water use, rights, and consumption pose a threat to BCT habitat and stream hydrology. Instream flow needs for BCT have been neglected. Extensive private land ownership on this GMU can hinder habitat improvement projects, often where they are most needed.
- 5) ***Other factors:*** It will be difficult to gain public support for changing management practices on established fisheries that occur in this GMU.

Conservation Objectives:

The conservation objectives for the Northern Bonneville Unit are to maintain 15 populations within 119.4 stream miles of occupied BCT habitat and 700 acres of lentic waters.

By drainage, the unit objectives proposed are to:

- 1) Maintain 2 populations and 5 occupied stream miles in the Ogden River drainage.
- 2) Maintain 4 populations and 10 occupied stream miles in the Weber River drainage.

- 3) Maintain 3 populations and 16.4 occupied stream miles and 350 surface acres of lentic water in the Jordan River drainage.
- 4) Maintain 6 populations and 88 occupied stream miles and 350 surface acres of lentic water in the Utah Lake/ Provo River drainage.

Sportfishing Objectives:

Sportfishing Activities for the Ogden and Weber River drainages will be pending completion of Conservation Objectives.

Other Sportfishing Objectives are to:

- 1) Maintain 2 populations and 30.2 occupied stream miles and 350 surface acres of lentic water in the Jordan River drainage.
- 2) Maintain 2 populations and 33 occupied stream miles in the Utah Lake/ Provo River drainage.

Actions:

- 1) ***Genetic Analysis:*** BCT samples from several streams must be identified to determine the status of BCT and the potential for BCT restoration in certain drainages.
- 2) ***Habitat enhancement:*** Instream flow needs and fish passage should be maintained throughout portions of this drainage to improve connectivity and spawning success of BCT populations. Screening of diversion intakes or infiltration galleries could also prevent losses of fish to irrigation canals.

Impacts from existing and proposed watershed development that affects riparian and instream habitat should be assessed and mitigation should be determined on a case-by-case basis. Mitigation actions may include bank stabilizations, runoff control structures, road closure, restoration and relocation.

Private lands available for conservation easements should be identified in appropriate areas. Funding mechanisms for easements and incentives must also be developed.

- 3) ***Nonnative control:*** Enforcement of existing laws will prevent illegal stocking. Also, public education on the benefits of ecosystem integrity, detrimental effects of nonnative introductions and disease transmission may reduce these threats.

Termination of any nonnative cutthroat or fertile rainbow trout stocking in waters that contain pure populations of BCT may be necessary in some areas. Natural barriers should be used where possible.

- 4) ***Reintroduction:*** Development of broodstock BCT populations will provide BCT for future reintroduction efforts and refuge sources.

Table 10 outlines the time frame for implementing Conservation Actions in the Northern Bonneville GMU. Table 11 outlines the time frame for implementing Sportfishing Actions. Actions listed in these tables are sequential from left to right. Years refer to action initiation date.

Table 10: Conservation Actions to be implemented in the Northern Bonneville GMU.

a) Ogden River subunit

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Ogden River						
- Cutler Creek	1996	1997				
- Cobble Creek	1996	1997				
- Middle Fork	1996	1997				
- Wheat Grass Creek	1996	1997				
- Left Hand Fork of So.Fk.	1996	1997				
- Right Hand Fork of So.Fk.	1996	1997				

b) Weber River subunit

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Lower Weber River						
- Arbuckle Creek	1996	1996				
- Gordon Creek	1996	1996				
- Dalton Creek	1996	1996				
- Strawberry Creek	1996	1996				
- Peterson Creek	1996	1996				
- Line Creek	1996	1996				
East Canyon Creek						
- Arthur Fork	1997	1997				
- Walton Creek	1997	1997				
- Shingle Mill Creek	1997	1997				
- Farrels Creek	1997	1997				
- Big Bear Creek	1997	1997				
- Toll Creek	1997	1997				
- Two Mile Creek	1997	1997				
- Three Mile Creek	1997	1997				

Lost Creek - Blue Fork Creek - Guildersleeve Creek - Hell Canyon - Killfoil Creek	 1998 1998 1998	1996 1998 1998 1998				
Echo Creek - Sawmill Creek	1998	1998				
Chalk Creek - East Fork Chalk Creek	1998	1998				
Upper Weber River - Bob Young Creek - Stillman Creek - Red Creek - Gardners Creek - South Fk of Weber - Smith Morehouse Creek - Moffitt Creek - Beaver Creek tribs. - other tributaries	 1996 1996 1996 1997 1997	 1996 1996 1996 1996 1996 1997 1996 1997				 1999

c) Jordan River subunit

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Jordan River						
- City Creek	1996	1996				1996
- Red Butte Creek						1996
- Red Butte Reservoir						
- Emigration Canyon Creek	1997	1997				
- Parley's Canyon Creek	1996					1996
- Lamb's Canyon Creek	1996					1996
- Mtn Dell Reservoir	1996	1996				1996
- Mtn Dell Creek	1996					1996
- Little Dell Reservoir						
- Mill Creek (SLC)	1997	1997				
- Bell Canyon Creek	1998	1998				
- Deaf Smith Creek						

d) Utah Lake/ Provo River subunit

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Wasatch Front tributaries - Dry Creek - Grove Creek - Battle Creek						
American Fork River - North Fork	1998					
Provo River - lower Provo River - Benches Creek - Little South Fork - Willow Creek	1998 1998 1998					
Hobble Creek - Wardworth Creek	1997	1997				
Spanish Fork - Fifth Water - Sixth Water - Tie Fork - Hall's Fork - Chases Creek - Shingle Mill Creek - Lake Fork Creek - So. Fk. Soldier Creek - Bennion Creek - Soldier Creek	1997 1997 1997 1997 1997 1997 1997 1997 1997 1997					
Thistle Creek - Nebo Creek - Holman Creek - Strawberry Reservoir	1999 1999	1999 1999				
Santaquin Creek	1999	1999				
Wardsworth Creek	1999	1999				

Table 11: Sportfishing Actions to be implemented in of the Northern Bonneville GMU.

a) Jordan River subunit

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Jordan River - City Creek - Red Butte Creek - Red Butte Reservoir - Emigration Canyon Creek - Parley's Canyon Creek - Lamb's Canyon Creek - Mtn Dell Reservoir - Mtn Dell Creek - Little Dell Reservoir - Mill Creek (SLC) - Bell Canyon Creek						

b) Utah Lake/ Provo River subunit

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Wasatch Front tributaries - Dry Creek - Grove Creek - Battle Creek	1997					
American Fork River - North Fork						
Provo River - lower Provo River - Benches Creek - Little South Fork - Willow Creek			1996			

Hobble Creek - Wardworth Creek						
Spanish Fork - Fifth Water - Sixth Water - Tie Fork - Hall's Fork - Chases Creek - Shingle Mill Creek - Lake Fork Creek - So. Fk. Soldier Creek - Bennion Creek - Soldier Creek						
Thistle Creek - Nebo Creek - Holman Creek - Strawberry Reservoir	1996					
Santaquin Creek						
Wardsworth Creek						

WEST DESERT MANAGEMENT UNIT

Unit Description:

The West Desert is comprised of streams in the western part of the Bonneville Basin. These streams flow from mountains to desert valleys where they historically became subterranean or intermittent. Currently, many of the streams are diverted at higher elevations for agricultural use. The only BCT habitat (historic or current) exists in small streams draining the relatively steep, small Deep Creek Mountain range. Other mountain ranges have limited available habitat and probably did not contain BCT.

The vegetational community in the Deep Creek Mountains is the characteristic high elevation, pinyon-juniper forests and sagebrush prairies. Riparian areas are commonly dominated by river birch and aspen. Elevation ranges from 6,000 to 9,000 feet for most streams. These relatively small, steep streams drain into the Snake River drainage.

Located on the west side of the Deep Creek Mountains is the Goshute Indian Reservation. This area is mineral rich; hence, the potential for future mining activities exists and could threaten BCT recovery efforts in this area. However, the relatively isolated location of these mountains has discouraged extreme human land use and water development.

Current Status and Distribution:

Currently, this GMU contains 3 pure populations within 22.2 stream miles. The Roosevelt Fish and Wildlife Management Assistance Office (Roosevelt FWMAO), U.S. Fish and Wildlife Service, has conducted a comprehensive survey of all tribal waters on the west slope of the Deep Creek Mountains. Genetic analyses of specimens collected from these streams indicate hybridization with rainbow trout, however South Fork of Johnson Creek has tested positive for genetic purity of BCT. Additionally, the headwaters of both Trout Creek and Birch creek, which contain pure strain BCT, are on or adjacent to the Goshute Indian Reservation. Given the excellent condition associated with Goshute tribal waters on the west slope of the Deep Creek Mountains, restoration activities on the Goshute Indian Reservation will play an important role in the conservation of BCT in the West Desert Management Unit. Table 12 shows the status and distribution of BCT among drainages.

Table 12: Status of BCT within the West Desert GMU. 'pure' = genetically pure; 'potentially pure' = awaiting genetic analysis. (See Definitions)

State Water ID #	Reach	BCT Status	OSM
IVAR370 IVAR360 IVAR380 IVAR390 IVAR400 IVAR410 IVAR420	East slope - Trout Creek - Birch Creek - Granite Creek - Cedar Creek - Indian Farm Creek - Thom's Creek - Basin Creek	pure pure potentially pure potentially pure suspected hybrid suspected hybrid suspected hybrid	4.2 3.0
Not State waters	West slope (Goshute Reservation) - South Fork of Johnson Ck - Spring Creek - Fifteen Mile Creek - Dad's Creek - Steve's Creek - Sam's Creek - Birch Creek	pure & hybrid hybrid hybrid hybrid hybrid hybrid hybrid	<5.0

Threats:

- 1) **Habitat degradation:** The most significant threat on this GMU is habitat fragmentation. Logging, grazing and mining pose minimal threats to BCT habitat at this time; however, because of the high potential for mining, habitat should be monitored for future evaluation.
- 2) **Detrimental interactions:** Illegal introductions of fish could spread disease to the BCT. Rainbow trout hybridization continues to pose a significant threat to BCT genetic purity in the West Desert.
- 3) **Over utilization:** A unique threat to BCT populations in this unit is the continued manipulation and removal of BCT and BCT eggs from West Desert waters for broodstock and reintroduction projects. This activity has the potential to deplete or alter the population gene pool. In addition, excessive sampling (e.g. electroshocking) may cause mortality among eggs and gravid females. The Goshute Tribe is extremely concerned about the removal of BCT and any activity that may affect the viability or long-term survival of BCT in Trout Creek, because its headwaters originate on the Goshute Indian Reservation and any activity downstream could ultimately affect BCT in upstream reaches.
- 4) **Inadequate regulation:** Geographic isolation of the West Desert unit makes enforcement of existing fishing regulations difficult.

Conservation Objectives:

The conservation objectives for the West Desert Unit are to maintain 10 populations within 61.7 stream miles of occupied BCT habitat.

By drainage, the unit objectives proposed are to:

- 1) Maintain 6 populations and 31.7 occupied stream miles in the East Slope of the Deep Creek Mountains.
- 2) Maintain 4 populations and 30 occupied stream miles in the West Slope of the Deep Creek Mountains.

Sportfishing Objectives:

The Goshute Tribe has long range plans to develop a recreational BCT fishery on their reservation, in conjunction with small reservoirs and campground developments. Additionally, conservation populations will provide sportfishing opportunity.

Actions:

- 1) ***Genetic analysis:*** Purity of some populations must be determined before further actions are taken.
- 2) ***Nonnative control:*** Selective control and/or eradication of nonnative species of trout will be initiated to maintain genetic integrity of BCT.
- 3) ***Reintroduction:*** Development of broodstock BCT populations will provide BCT for future reintroduction efforts and refuge sources. Also, size selective transplanting and fishing regulations will be implemented.
- 4) ***Habitat Enhancement:*** In several streams, fish barrier structures are necessary to prevent invasion of nonnative salmonids.

Table 13 outlines the time frame for implementing Conservation Actions in the West Desert GMU. Actions listed in these tables are sequential from left to right. Years refer to action initiation date.

Table 13: Conservation Actions to be Implemented for the West Desert GMU.

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
East slope - Trout Creek - Birch Creek - Granite Creek - Red Cedar Creek - Indian Farms Creek - Tom's Creek - Basin Creek	1996,99 1996,99 1996,97 1997,98 1996,97 1998 1998		2000 2000 1997 1998 1997 1999 1999	2001 2004 1998	2002 2005 1999 1996	1996 1996 2003 2006 2000 1997
West slope (Goshute Reservation) - South Fork of Johnson Cr. - Spring Creek - Fifteen Mile Creek - Dad's Creek - Steve's Creek - Sam's Creek - Birch Creek	1996 1996 1996 1996	1996 1996 1996	1996 1996 1996 1997 1997 1997	1997 1996 1996 1997 1998 1998	1997,98 1997,98 1997,98 1997,98 1998 1998 1998	1996-99 1996-99 1996-99 1996-99 1996-99 1996-99 1996-99

SOUTHERN BONNEVILLE MANAGEMENT UNIT

Unit Description:

This GMU encompasses what was once the southwest area of pluvial Lake Bonneville. Today, this area comprises the Sevier River drainage, including the relatively discrete Beaver River drainage. The Southern Bonneville GMU also contains a portion of the Virgin River drainage. Although the Virgin River drains into the Colorado River system, the presence of BCT in some streams on the Pine Valley Mountains (a portion of the Virgin River basin) suggests a recent geologic stream capture event. The elevation of the Southern Bonneville GMU ranges from 5,000 to over 10,000 ft. This area is characterized by a high elevation desert climate with pinyon-juniper forests and sagebrush prairie. Stream hydrology approximates typical high mountain desert systems with spring flooding and low to intermittent fall and winter base flows.

Current Status and Distribution:

In the Southern Bonneville unit, BCT are found in the Virgin River drainage and in the main Sevier River drainage which includes the Beaver River drainage. Historically, populations of BCT within this GMU probably were fragmented naturally by geographic barriers. Currently, this GMU contains 14 pure populations occupying 35.8 stream miles and 58 surface acres of lentic water (Table 14).

Table 14: Current status of BCT in the Southern Bonneville GMU. 'pure' = genetically pure; 'potentially pure' = awaiting genetic analysis. (See Definitions)

State Water ID #	Reach	BCT Status	OSM
IAA020C2 IAA020C1 IAA060B IAA060A IAA040	Virgin River - Reservoir Canyon - Water Canyon - Leap Creek - South Ash Creek - Leeds Creek	pure pure pure (transplanted) pure (transplanted) pure (transplanted)	2 0.5 1.5 5.8 4.2
VIAB050A2 VIAB070B2 VIAB010B VIAB070A	Beaver River - Birch Creek - Briggs Creek - Pine Creek - North Fork of North Cr.	pure pure (transplanted) pure (transplanted) pure	3.5 0.6 3.3 2
VIAA510M01 VIAA360A VIAA680 VIAA430 VIAA430 VIAA510G01	Sevier River - Ranch Creek - Sam Stowe Creek - Threemile Creek - Manning Meadow Res. - Manning Creek - Deep Creek	pure pure (transplanted) pure (transplanted) pure (brood stock) pure	2.4 3.0 1 58 sa 1 5

Threats:

- 1) ***Habitat degradation:*** Water development projects (depletions, dewatering, migration barriers), live-stock grazing, timber harvest and road construction are potential threats which could modify or further fragment BCT habitat. At present, state and federal laws, policies, regulations, and plans prevent indiscriminate actions and provide protection for BCT habitat. Such regulatory mechanisms did not exist when drastic BCT population declines occurred.

Fires and floods are a threat to small, isolated BCT populations. These threats are usually associated with fragmented habitat. Small populations potentially are subject to random events that threaten their existence. Such threats decrease with increasing populations, population size, habitat complexity and connectedness.

- 2) ***Over utilization:*** The threat of over-harvesting from fishing pressure is not acute at this time. Most streams either have large areas that are not likely to be over-fished, or the streams are remote enough that over-use is not a factor. Small streams do not usually produce trout of a sufficiently large enough size to generate angling interest. Although fishing pressure is currently not considered a threat on the Southern Bonneville GMU, future conservation of BCT should consider this a potential threat.
- 3) ***Detrimental interactions:*** Whirling disease has been found in the East Fork of the Sevier River in the Southern Bonneville unit. However, the future threat of this disease spreading into native fish populations is greatly reduced by established procedures and protocols (e.g. disease certifications) which protects populations and requires approval for transplanting live fish.

Predation, competition and hybridization do not pose a serious threat to existing BCT populations, because they are currently isolated from other fish populations. These threats will need to be considered and properly eliminated as new populations are restored into historic habitat that presently contains nonnative species.

Conservation Objectives:

The conservation objectives for the Southern Bonneville Unit are to maintain a minimum of 14 populations within 79 stream miles and 73 surface acres of lentic water of occupied BCT habitat.

By drainage, the unit conservation objectives proposed are to:

- 1) Maintain 5 populations and 33 occupied stream miles in the Virgin River drainage.
- 2) Maintain 4 populations and 21 occupied stream miles in the Beaver River drainage.
- 3) Maintain 5 populations and 25 occupied stream miles and 73 surface acres of lentic water in the Sevier River drainage.

Sportfishing Objectives:

By drainage, the unit Sportfishing objectives proposed are to:

- 1) Maintain 30 occupied stream miles and 250 surface acres of lentic water in the Virgin River drainage.
- 2) Maintain 30 occupied stream miles and 1100 surface acres of lentic water in the Beaver River drainage.
- 3) Maintain 50 occupied stream miles and 1430 surface acres of lentic water in the Sevier River drainage.

The following list provides general Sportfishing objectives:

- 1) Expand sport fishery management of BCT by incorporating native trout into routine sportfishing management programs.
- 2) Transplant both Deep Creek and Ranch Creek BCT into an additional three drainages. Neighboring streams will be assessed as possible transplant sites.
- 3) Expand other conservation populations of BCT when and where opportunities arise to promote sport fishing opportunities for native trout as well as conservation. Additional areas should be considered in the Sevier and Beaver River drainages.
- 4) Initiate habitat improvements as submitted to the U.S. Forest Service and the BLM with concurrence of the BBCRT. Habitat improvements will be determined by monitoring established reference sites on BCT streams and by standard USFS conditions.

Actions:

- 1) ***Habitat enhancement:*** Habitat restoration has been an ongoing project in the Southern Bonneville GMU since 1976. Habitat enhancement projects include: fencing and changes in grazing practices, road closures and relocations to protect streams, installation of instream structures designed to create fish habitat and naturally stabilize stream banks, construction of fish barriers to prevent emigration of nonnative salmonids into BCT range, and changes in land resource management designations. All but three BCT streams in the Southern Bonneville GMU are presently designated through the U.S. Forest Service Management Plans as “emphasis on fish habitat improvement” or “intensive riparian management”, or are located in federal “wilderness areas”.
- 2) ***Reintroduction:*** The ongoing program of expanding populations by reintroductions into historic habitat will continue. This includes renovation projects and construction of migration barriers to remove the threat of nonnative fish introductions. Populations are being introduced into fourth order drainages with first, second and third order tributaries.

A wild broodstock of Southern BCT which has been developed and incorporated into general sport fishery management.

- 3) ***Nonnative control:*** Stocking of nonnative cutthroat trout has been discontinued in the Sevier, Beaver and Virgin River drainages and has been replaced by native trout stocking (see #2 above).

Table 15 outlines the time frame for implementing Conservation Actions in the Southern Bonneville GMU. Actions listed in these tables are sequential from left to right. Years refer to action initiation date.

Table 15: Conservation Actions to be implemented in the Southern Bonneville GMU

Reach	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
Virgin River - Reservoir Canyon - Water Canyon - Leap Creek - South Ash Creek - Leeds Creek Colorado River basin - Spring Creek of Huntington Creek						1997,99 1997,99 1997,99 1996,98 1996,98 1996
Beaver River - Birch Creek - Briggs Creek - Pine Creek - North Fork of North Cr.			1997			1997,2000 2000 2000 1997
Sevier River - Ranch Creek - Sam Stowe Creek - Threemile Creek - Manning Meadow Res. - Manning Creek - Deep Creek - South San Pitch Creek		1996 1996 1996	1996 1997 1997	1997 1996	1997,98 1996	1997,99 2001 1996,97 1996 1997 1996,2001 1996

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